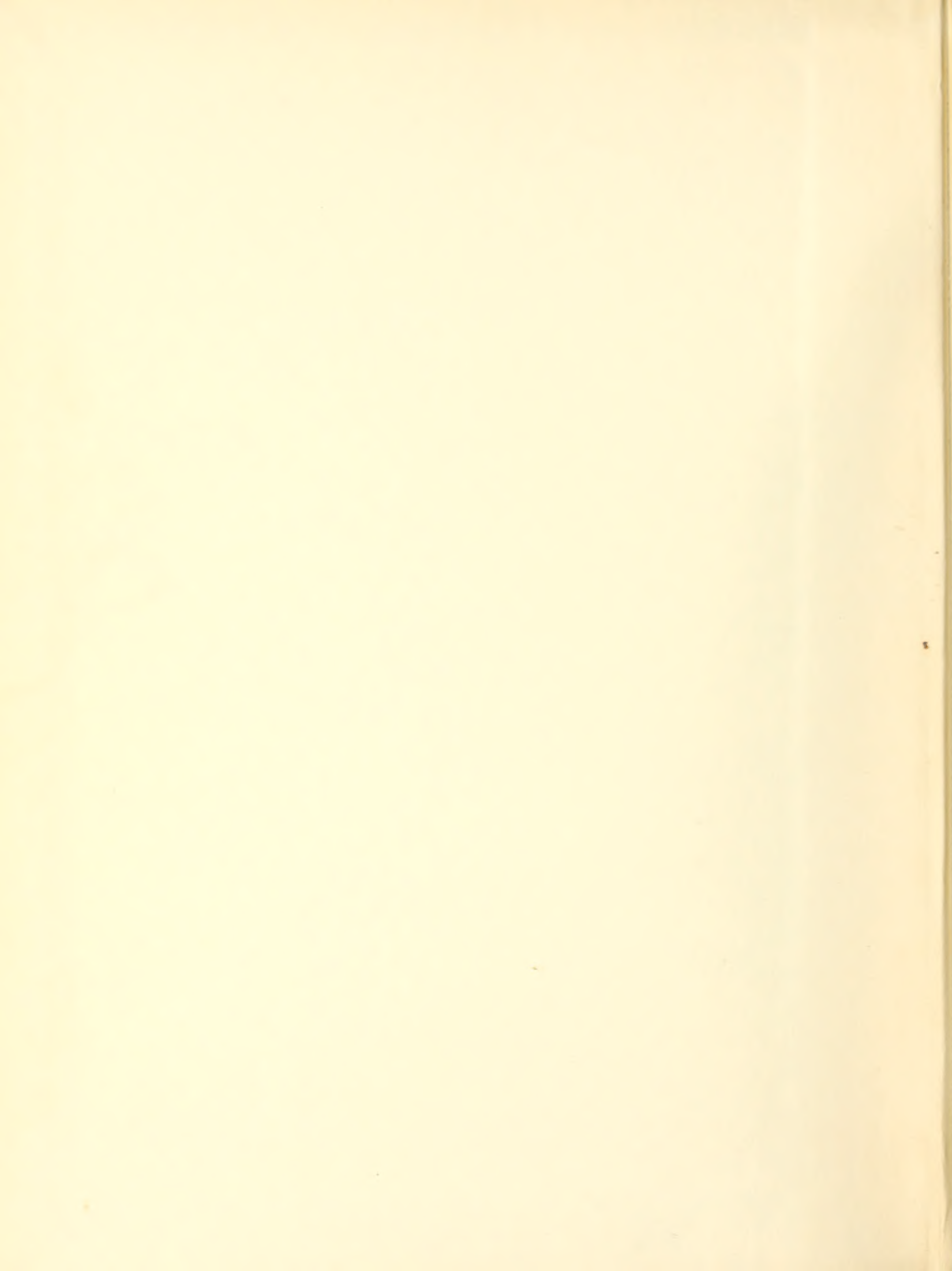






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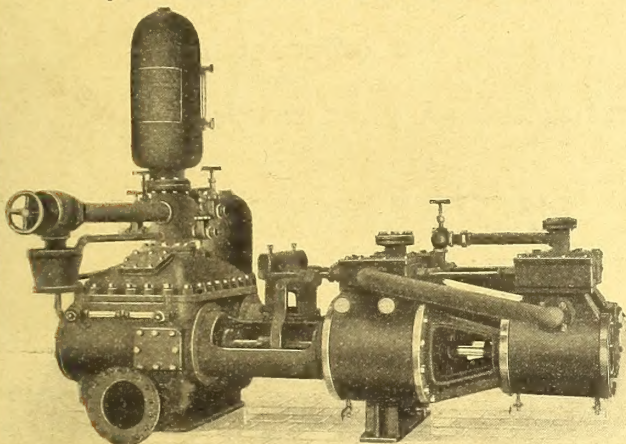
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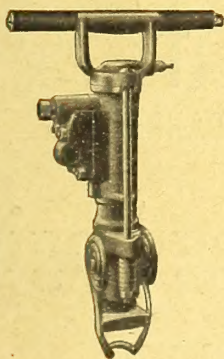
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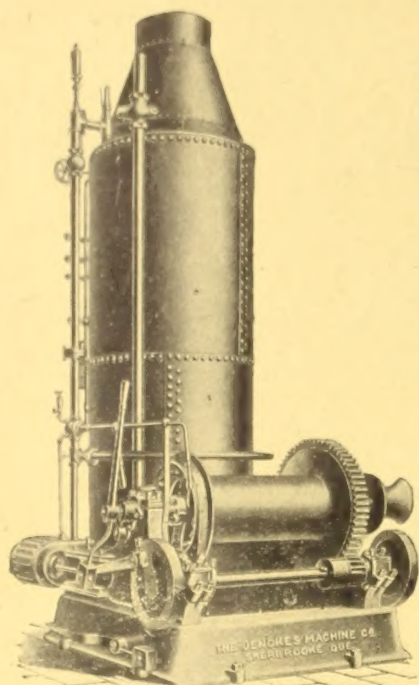
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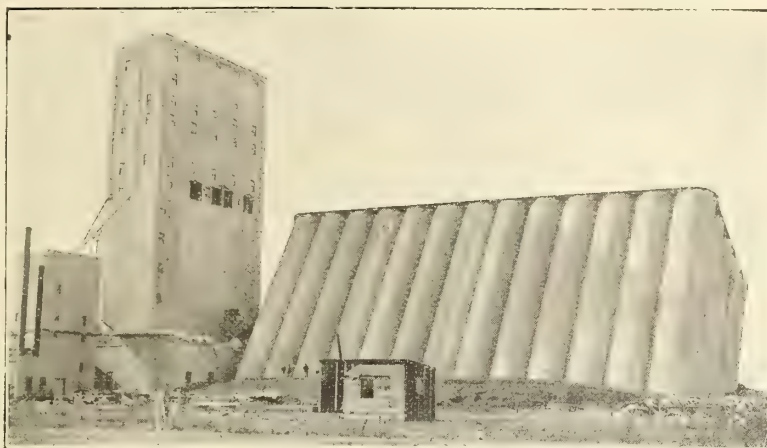
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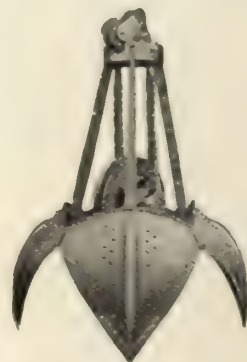
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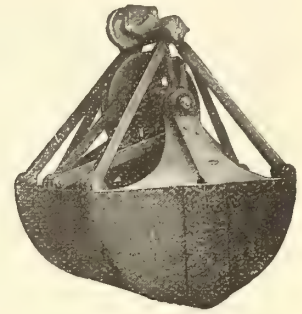
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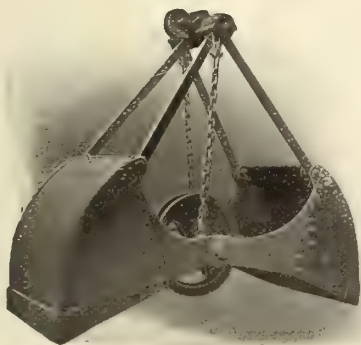
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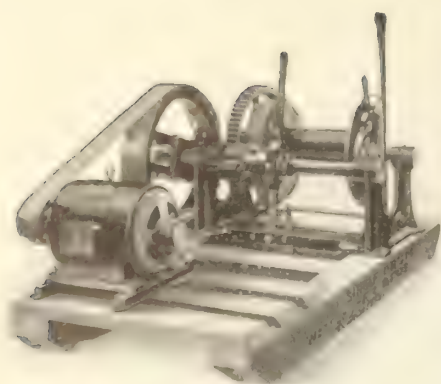
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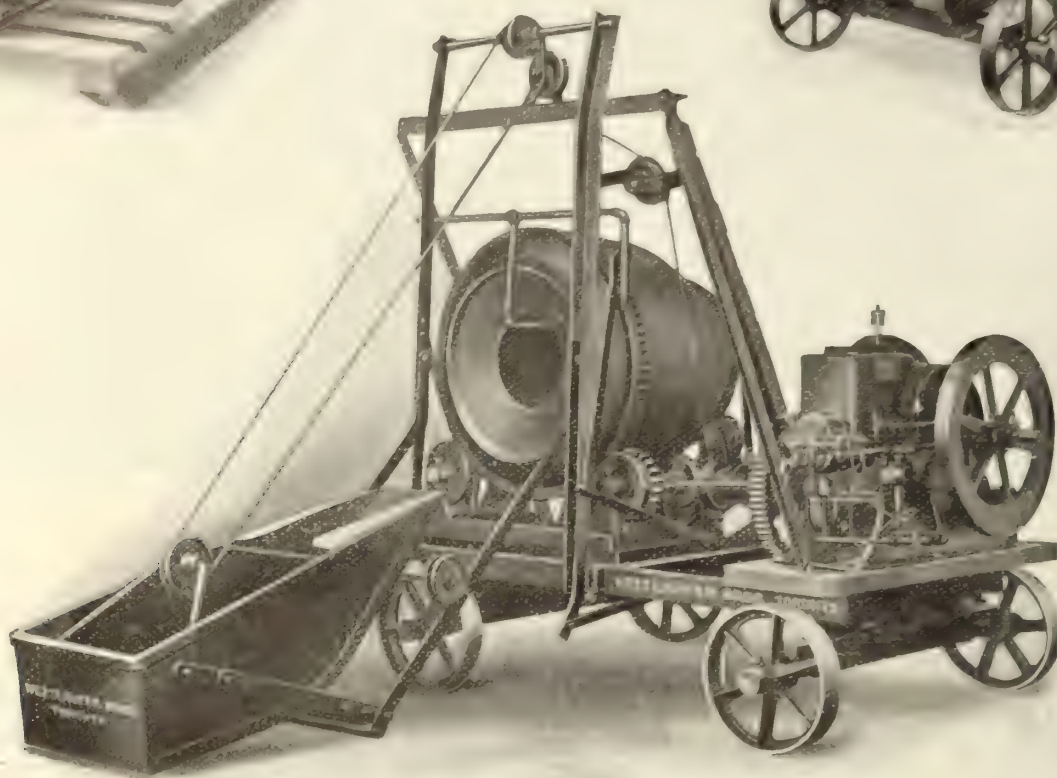
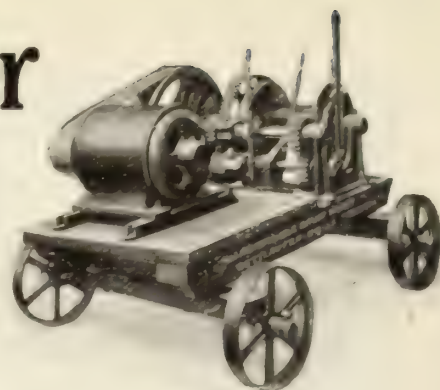
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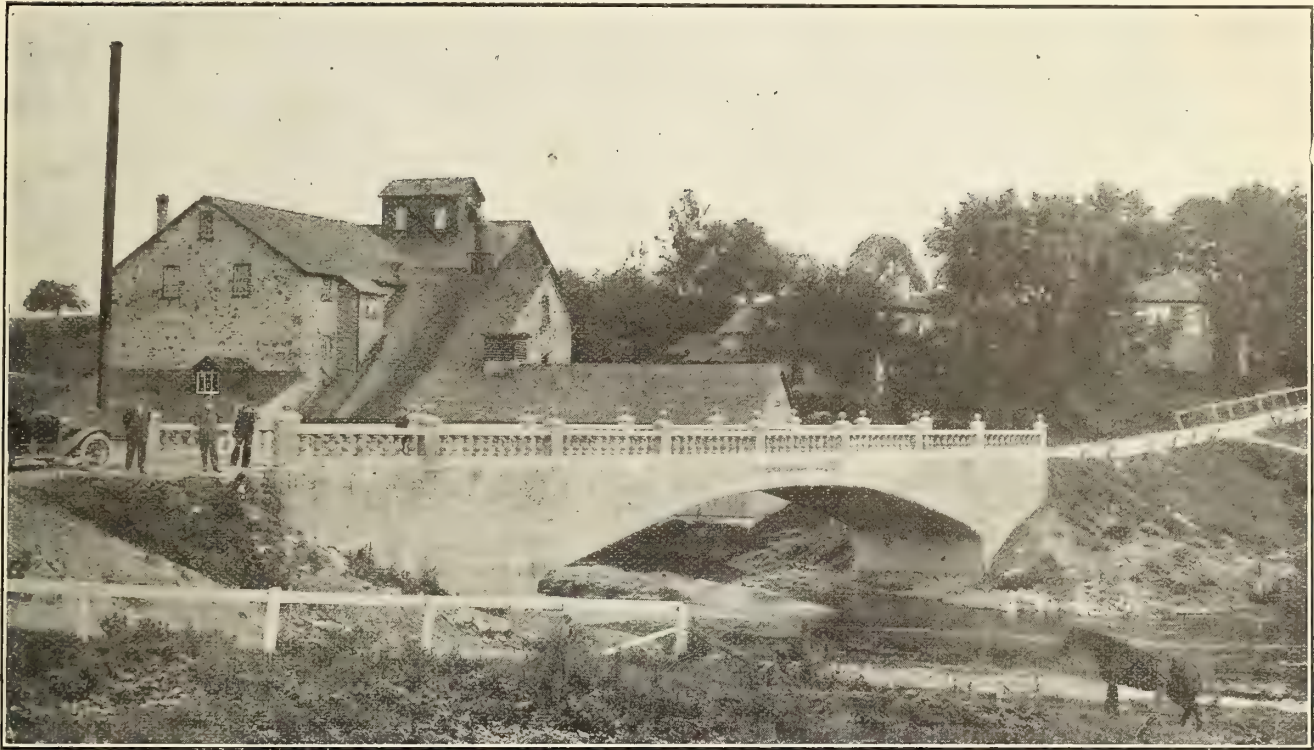
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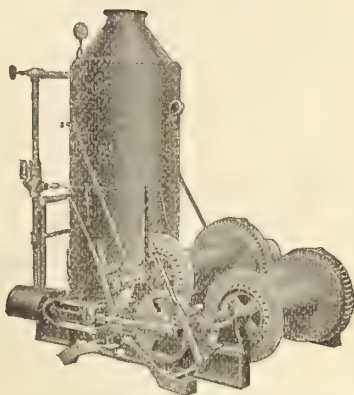
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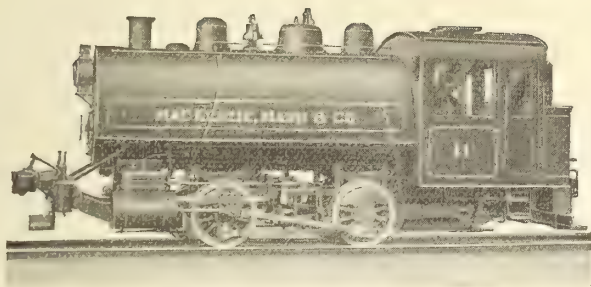
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(Continued on page 14)

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THE smallest amount of current on the heaviest load is accurately measured on a Ferranti meter. Our meters are guaranteed for three years against all mechanical or electrical defects.

Ferranti meters are assembled and thoroughly tested at our Toronto or Winnipeg warehouses where a large stock is always on hand.

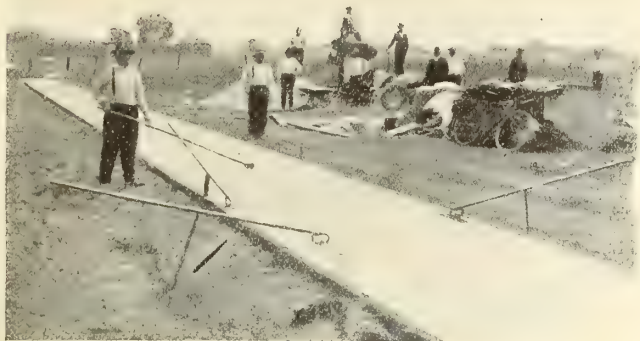
Illustration shows our improved type "C" meter, single or polyphase; top or bottom connections; clock or cyclometer dials.

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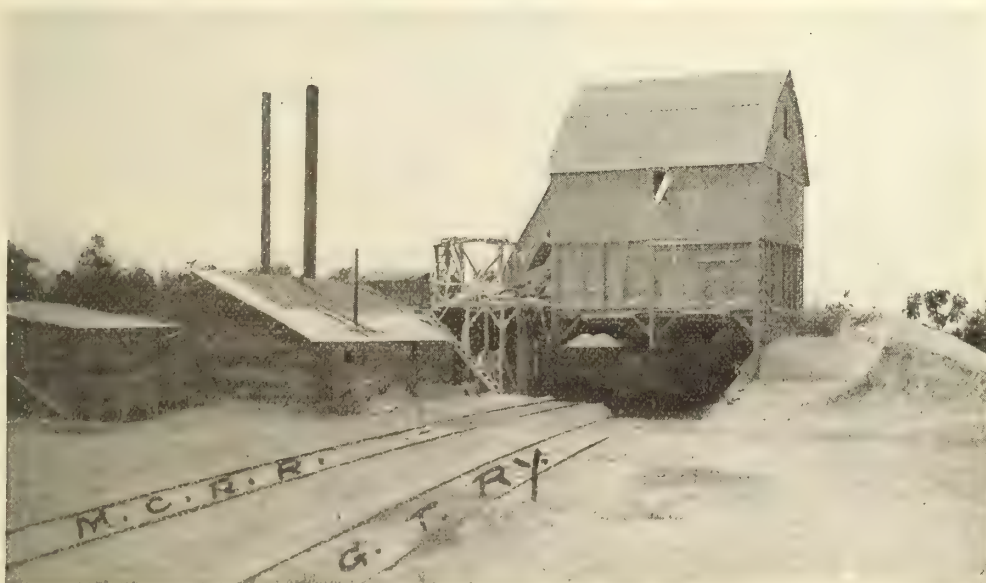
Earth and Stone Handling Machinery

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Macadam Roads



*must be built
of a*

Tough Stone

*that
will cement*

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Hagersville - Ont.

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What Big Contractors

Say About This Koppel Car

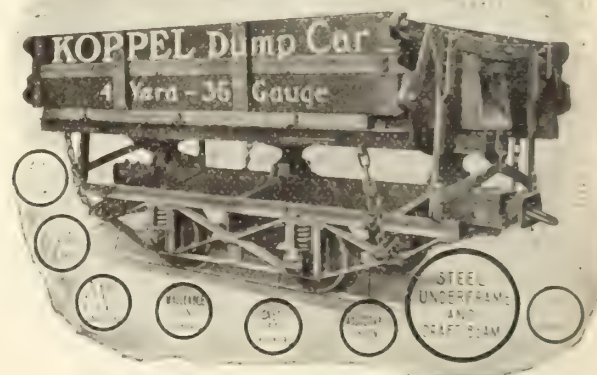
Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.



Orenstein-Arthur Koppel Co.

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THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

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Tarvia

*Preserves Roads
Prevents Dust~*

This road was 10 feet under water

The roadway illustrated above runs along the banks of the Wabash River at West Lafayette, Indiana, U. S. A.

In March 1913, the great floods raised the river to the white mark on the tree at the left of the picture, completely submerging the macadam roadway.

This stretch of road was constructed in 1911 with "Tarvia X", and the condition of the highway after the flood gives ample demonstration of the fact that a Tarvia-bonded roadway is waterproof.

Tarviated macadam sheds an ordinary rainstorm immediately. Water does not percolate into the surface or loosen the Tarvia bond.

In this instance, the road got more than an ordinary wetting but after the water receded the macadam was found in excellent condition, unchanged in contour, and ready for traffic without any attention or repairs.

"Tarvia X" is a dense, viscid, coal tar compound of great adhesive power and immune from damage by water or weather. Used as a binder, it so increases the strength of the macadam as to make it automobile proof and erosion proof. The saving in maintenance expense and the prolongation of the life of the road more than balance the cost of the Tarvia treatment.

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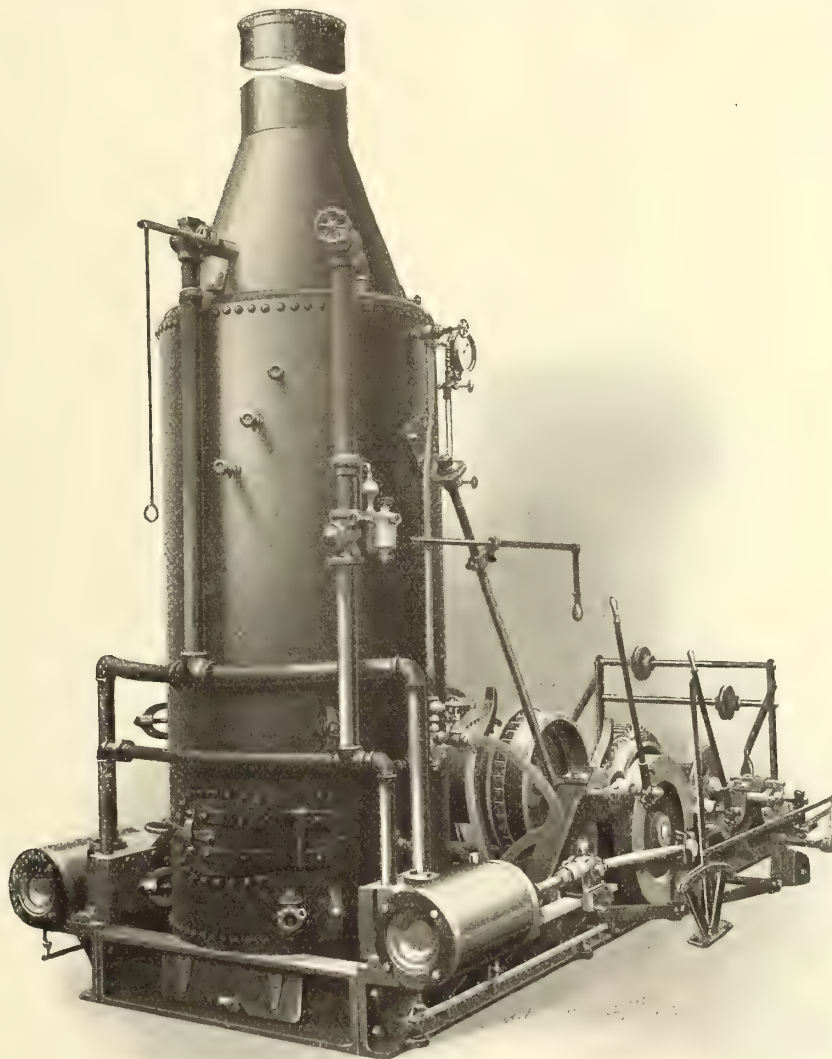
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If you wish to **know why** the Napanee Hoists are so superior in design, material and workmanship, write us for information and we will be glad to send you specifications and details and to refer you to actual users so that you can **judge for yourself**.



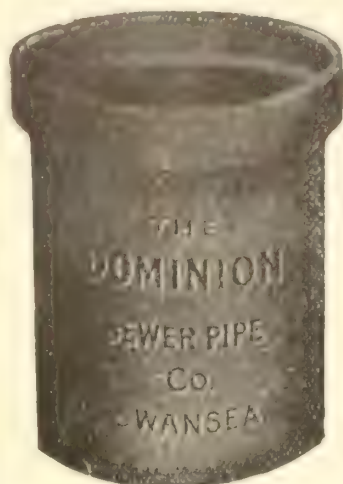
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Philadelphia, Pa.

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The Ontario Sewer Pipe Company, Limited, Mimico, Ont.

TELEPHONES—Toronto Connections, Park 422. Evenings—Park 3888 and 3889.



Sewer Pipes

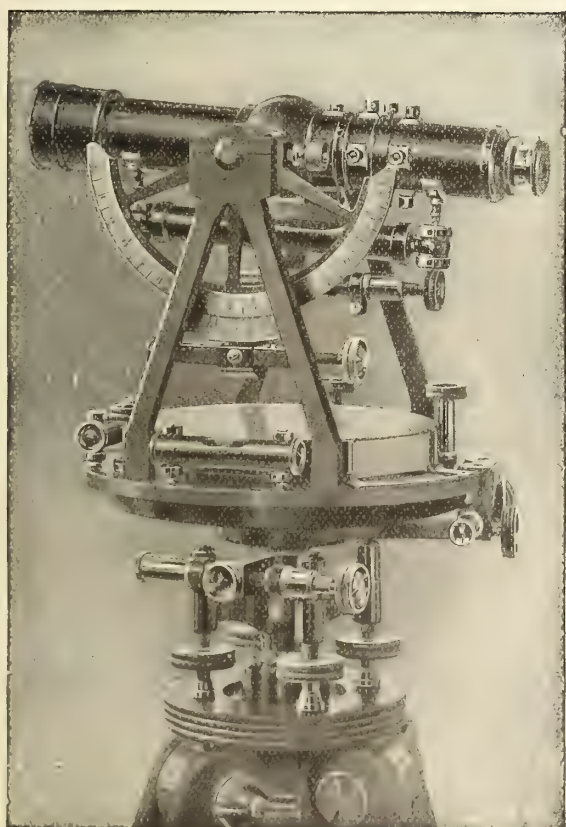
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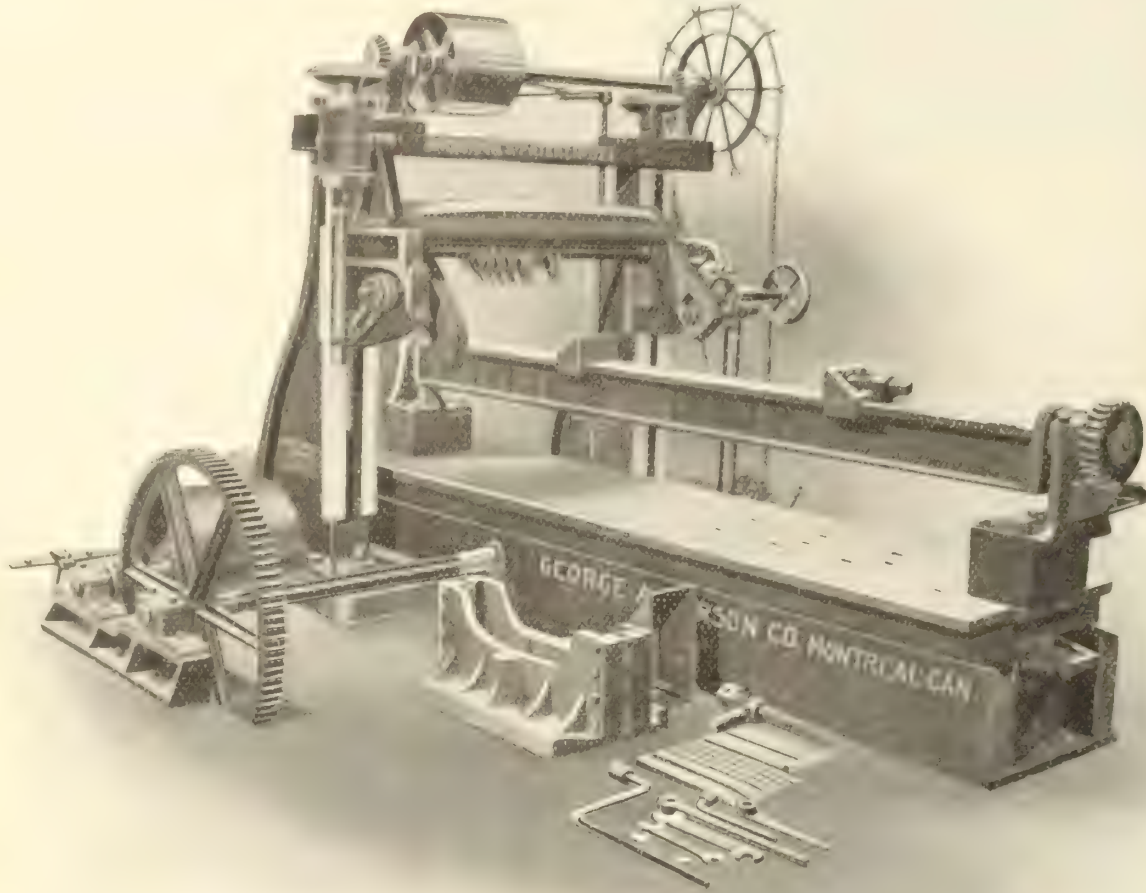
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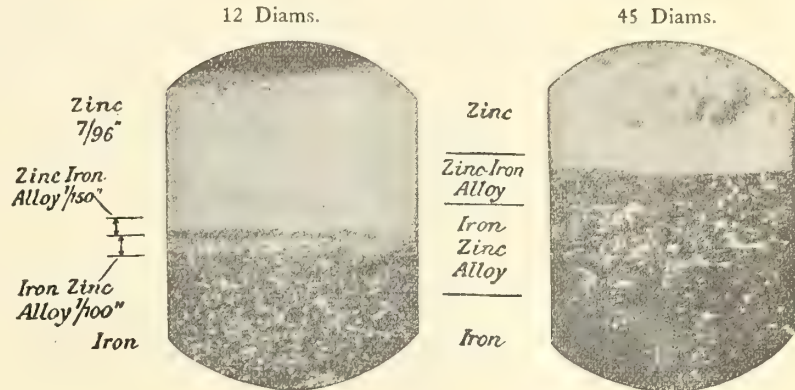
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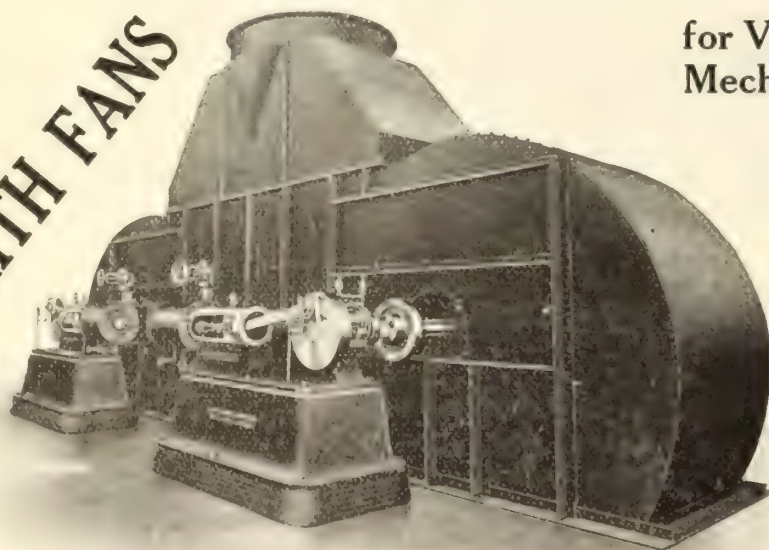
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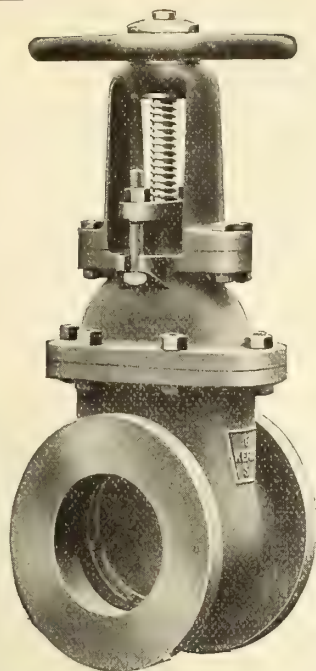
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They have been designed and are built to meet the specifications of the most exacting and critical Engineers, and will bear the rigid scrutiny of "THE MAN WHO KNOWS."

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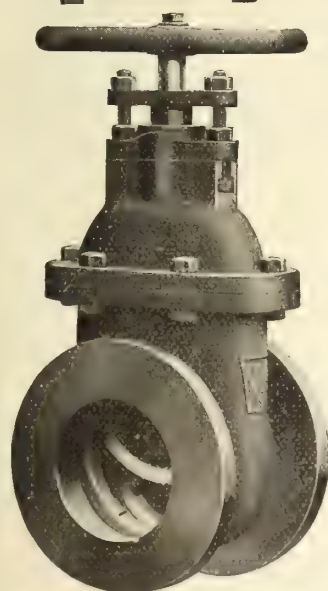
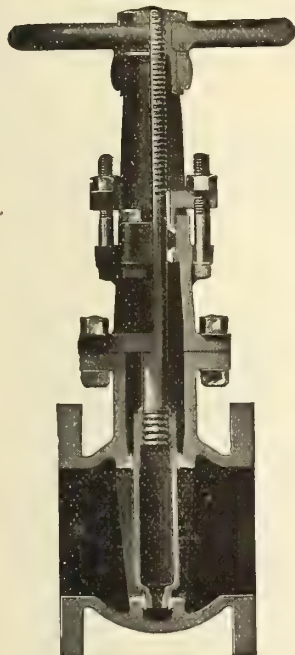
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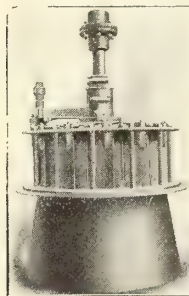
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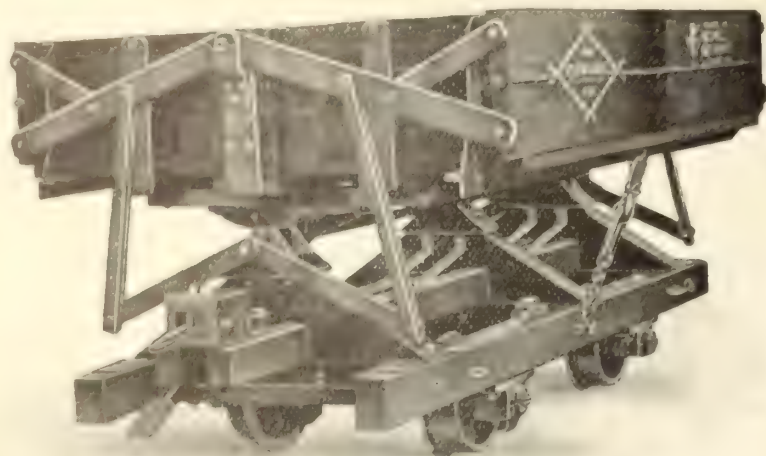
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For contractors on small jobs, or for jobs
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Showing standard construction of our Wood Frame Dump Cars 1½ and 1¼ yds.

"GLEN GARRY" 1¼ AND 1½ YD. TWO-WAY SIDE DUMP CARS

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THE REASON WHY

The smallest Thew does the work of from twenty to forty men at one-third of the cost. The Thew, being able to load a wagon a minute, will often save enough in team time to pay its entire operating cost, which means that you are loading dirt for practically nothing. Hand labor is difficult to secure, hard to hold and inefficient in practice, while the Thew is always on the job.

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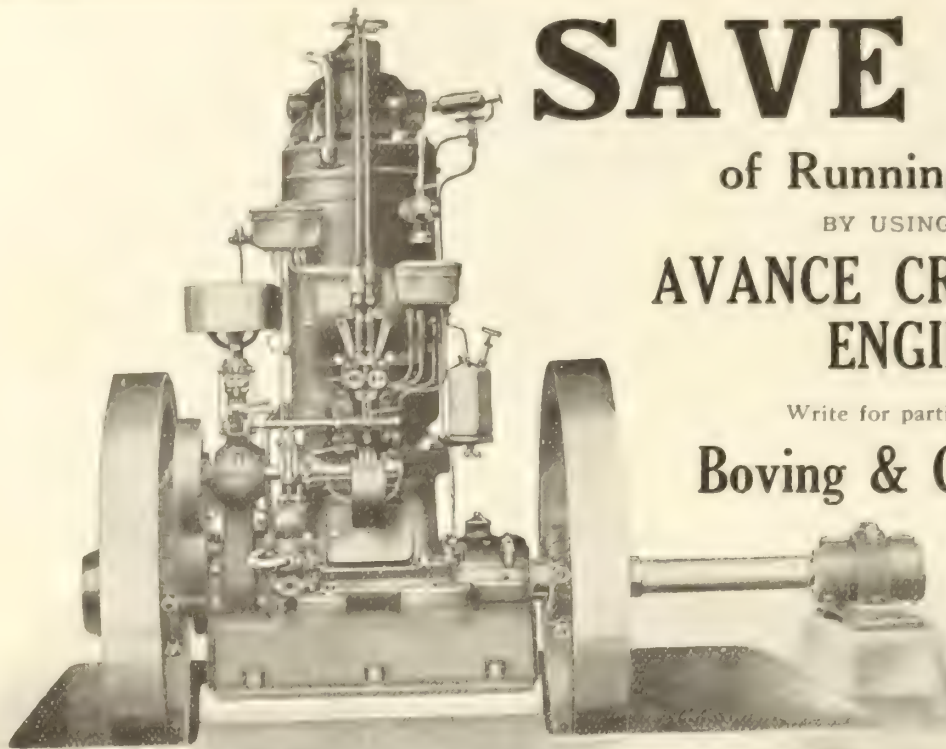
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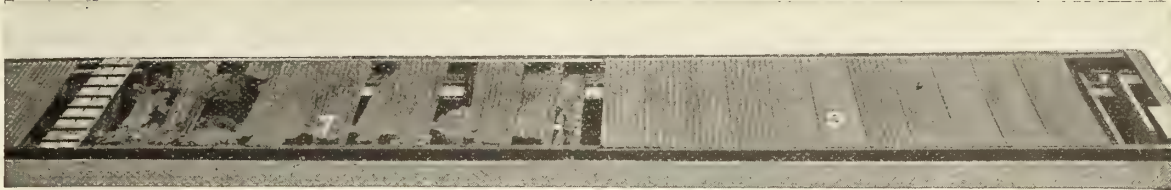
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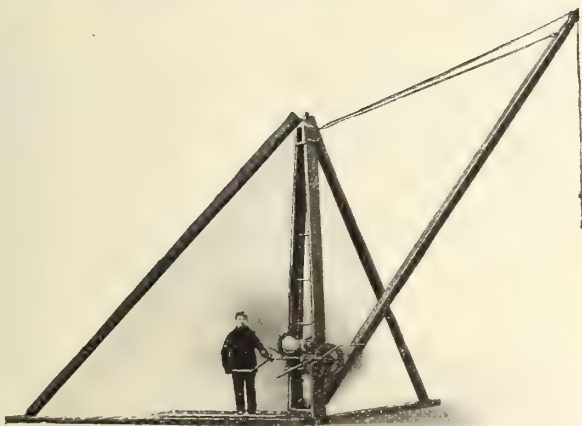
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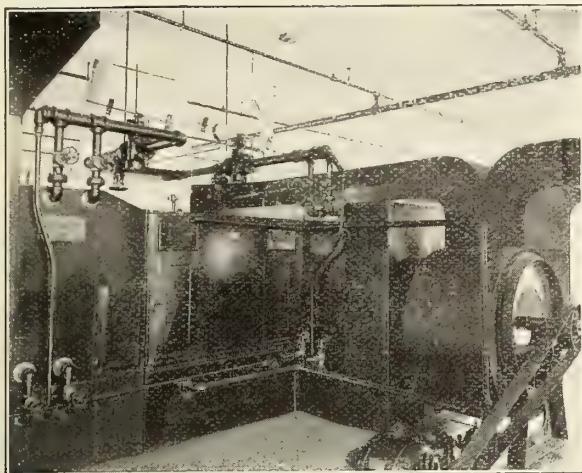
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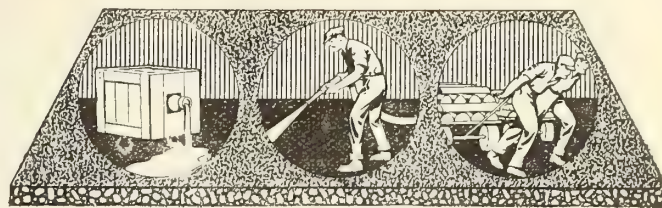
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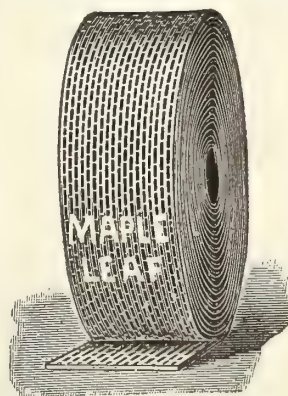
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It is the most economical Belting because it is durable under every condition; even where other Belting will deteriorate rapidly. It is water proof.

It runs absolutely true on the Pulleys.

It is built of plies of selected duck.

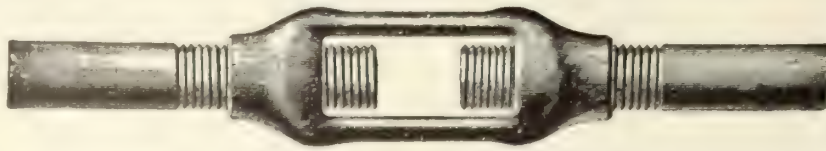
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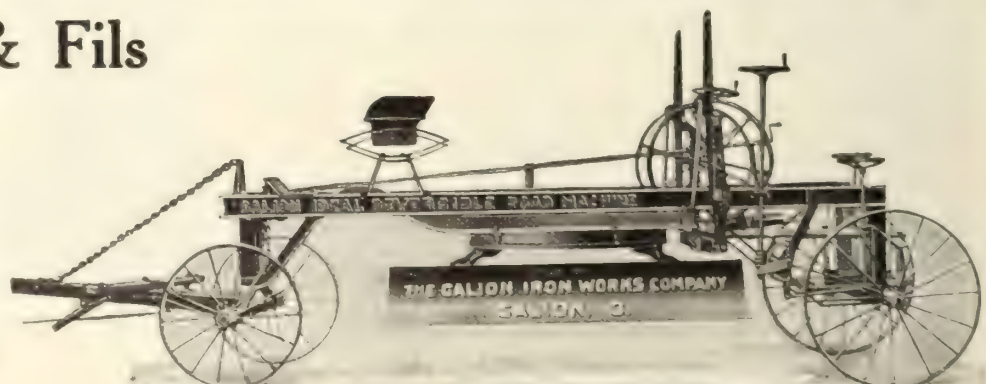
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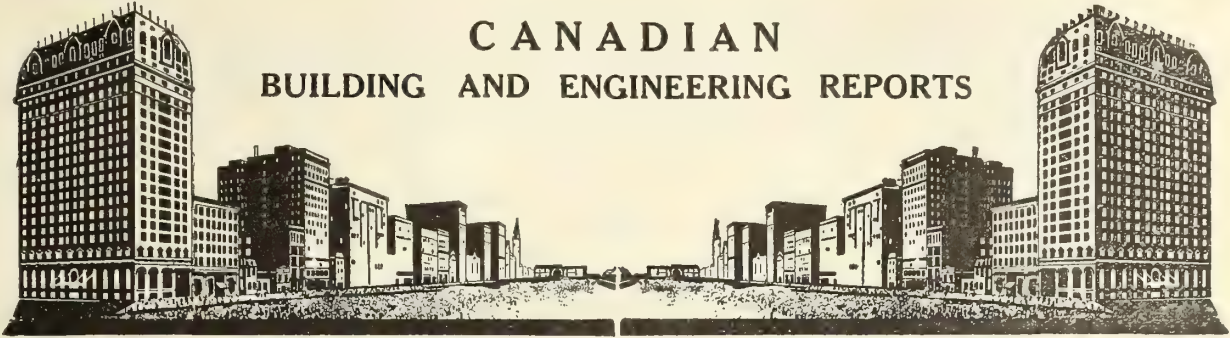
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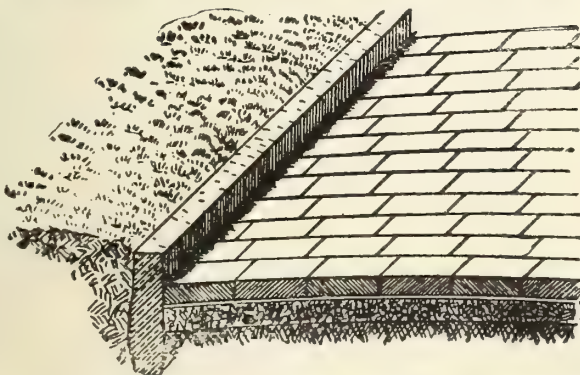
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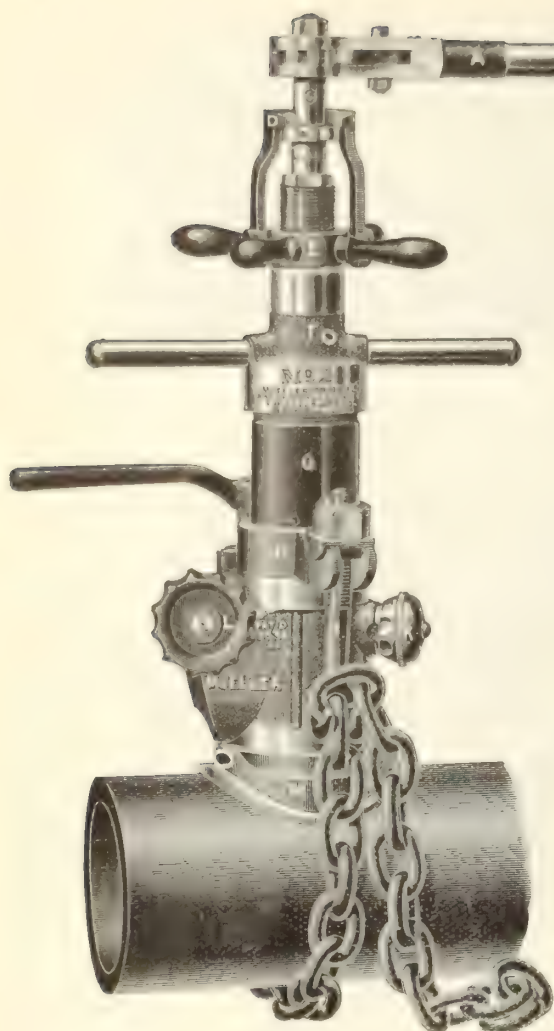
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That will give you some idea of the enormous strength built into Goodyear Belts. Not an ounce of untested rubber is used, not a roll of untested duck. Each finished Belt is inspected before shipping *to make sure* that it will stand the *wear* and keep *pliable*.

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A close, clinging grip of the pulleys—absolutely non-slipping. Goodyear Rubber Belting gives this cohesive contact because of its yielding rubber surface, and the practical result is an immense saving of power.

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Long Life. The duck or fabric of Goodyear Belting cannot be reached by water, or anything else that would set up rot and destroy the Belt. A Goodyear Belt renders long and efficient service.

104

GOOD YEAR

Rubber Belting

Factory Superintendents specify Goodyear Belting. They are satisfied that Goodyear Rubber Belting puts the plant on a power-saving basis. Write for free Book on the choice of a belt.

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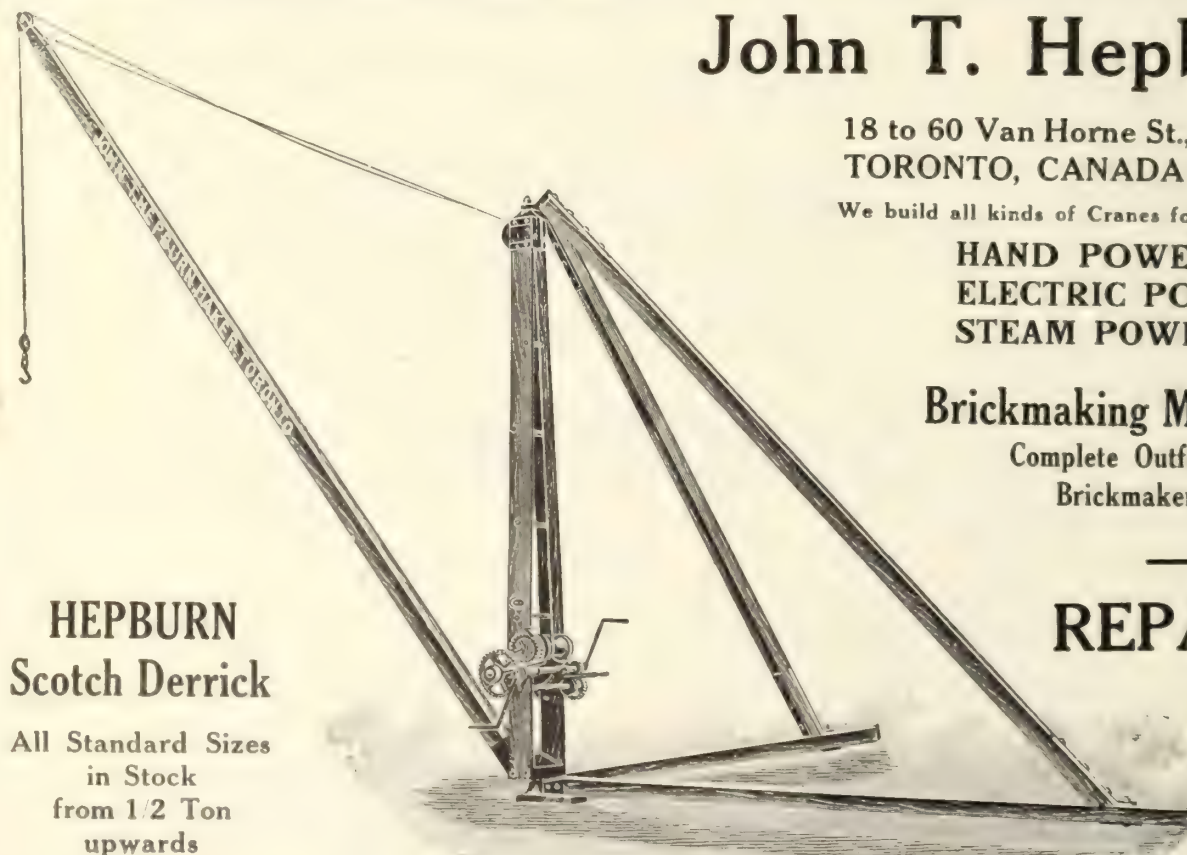
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Aztec is supplied with the consistency best suited to the special purposes for which it is required. Prompt deliveries on asphalt for

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Insulating

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In 1910 we built a three story reinforced concrete factory building for these people at Walkerville, Ont. Since that time our men have never been off the job. We have built two large extensions to main factory building, a large fireproof office building, an engine house, gas producer building, heat treatment building with two large extensions, amounting in all to \$450,000.00.

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Made of

Anti-corrosive



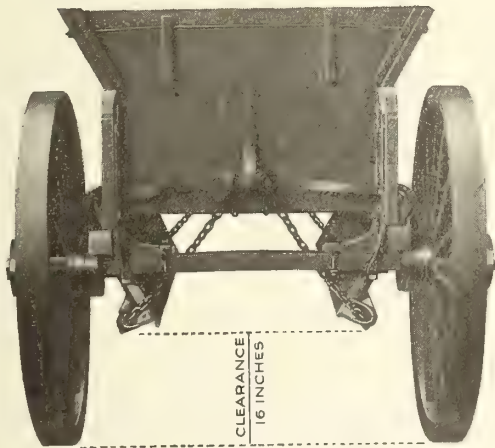
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He will say, "Get TROY Reversibles."

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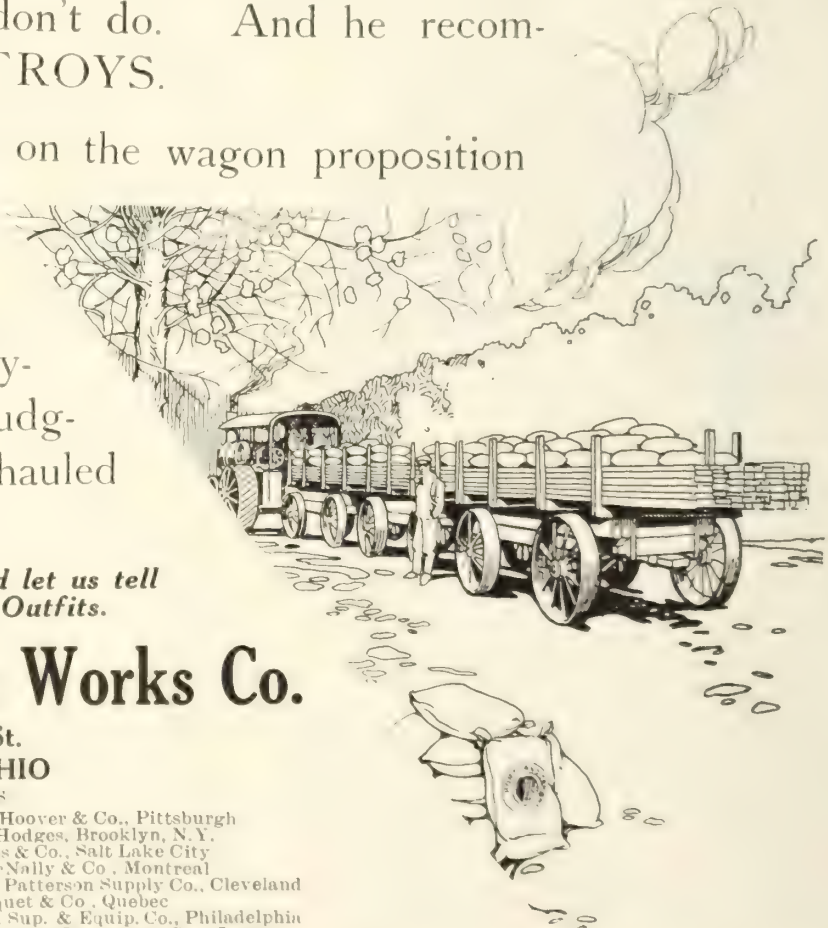
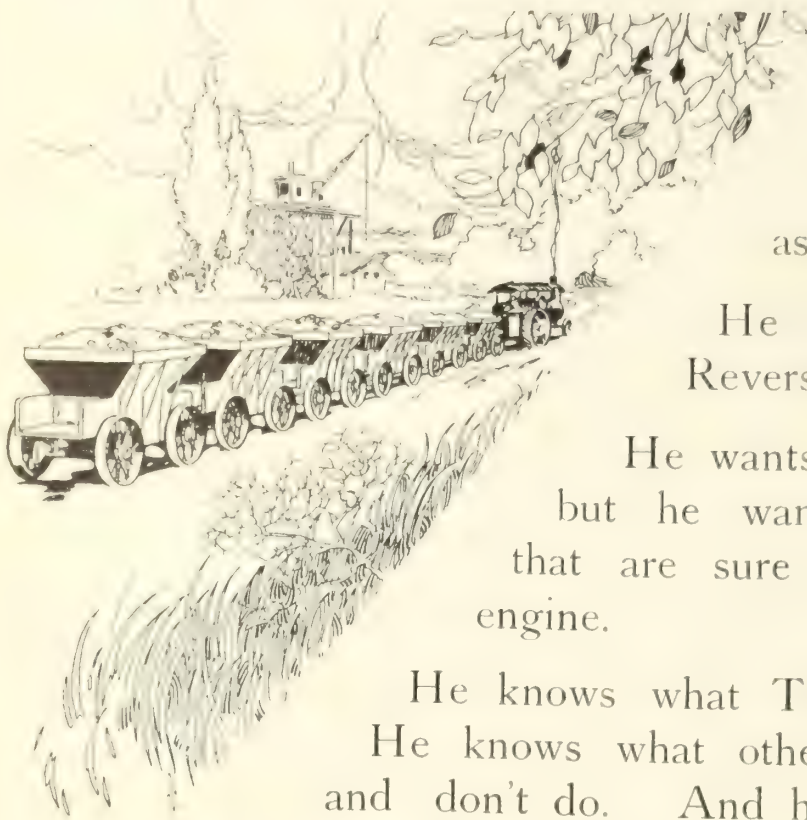
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The Troy Wagon Works Co.

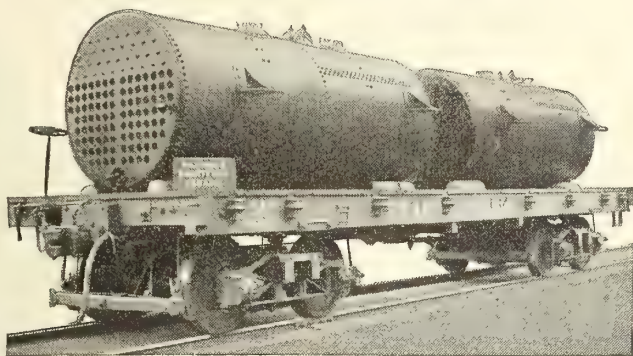
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WATEROUS RETURN TUBULAR BOILERS

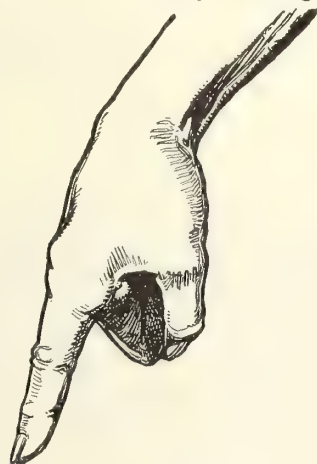


The Return Tubular Boiler is the best all-round boiler for continuous, seven-days-in-the-week, industrial service. Waterous boilers are the best built boilers of this type. They are economical of fuel — carry a large reserve steam pressure for use in emergencies — will use hard and dirty water and are easily handled and readily cleaned.

We build all sizes up to 250 H. P. and can supply most of them direct from stock.

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They are used where service counts.

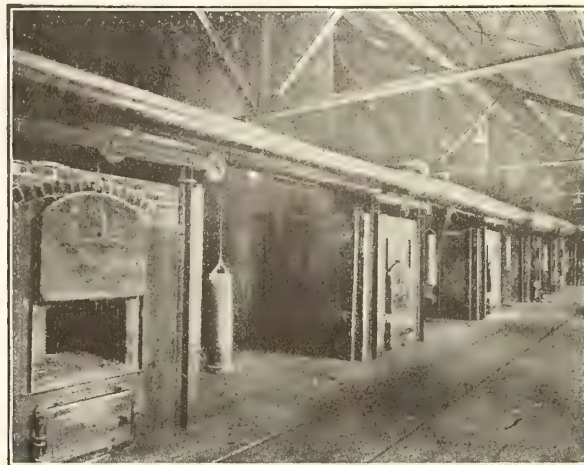


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ESTABLISHED 1886

and Engineering Review

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COMMENCING with this the first issue of the New Year, the advertising and editorial pages of the Contract Record and Engineering Review will be numbered separately and the principal contents indexed. The increased percentage of our readers who make a careful and systematic reading of the journal has rendered it highly desirable for us to provide a means of ready reference, and we believe that a weekly index and separate page numbering, taken in conjunction with an annual index of contents, will greatly enhance the value of the publication, especially to those, whose number is also increasing, who bind their copies.

The year with the unlucky terminal numbers has passed into history and we have entered upon the Year of Grace, Nineteen Hundred and Fourteen. We feel sure that in the constructional field there will be great achievements to record and we are determined to keep pace with our readers in the march of progress. The record of achievement must be made through a medium which is a credit to the progressive interests it serves. It is the policy of the publishers to strive to make the Contract Record pre-eminent in its field and to introduce from time to time such improvements as will make the journal regarded as a standard. The policy which has been in evidence in the immediate past will be maintained on more aggressive lines, special attention being devoted to the more practical features of large constructional operations. The municipal field will be covered carefully, particularly in regard to developments in design, construction, operation and equipment.

We wish our readers all prosperity during 1914 and bespeak their continued co-operation.

The Awakening of the Clay Industry

EDUCATIONAL facilities for the clayworker, discussed editorially at some length in our issue of December 10, 1913, would appear to be a live issue, judging by the correspondence on the subject published elsewhere in this issue and also by the announcement that the Canadian Clay Products Manufacturers' Association has concluded arrangements for the equipment of an up-to-date clay-working department in the new technical school. This is an excellent beginning and it is to be hoped that it will stimulate other educational authorities into action. Doubtless many interesting details will materialize at the forthcoming annual convention of the Association, but we are sure that the equipment of the new department at Toronto will be thoroughly up-to-date and that the requirements of all will be met by the proposed programme of a regular course of ceramics, extending over perhaps two or three years, and a short winter term of two or three months at practical work.

It is evident from President Falconer's letter, published in this issue, that the University authorities were favorably disposed towards a course of ceramics, but in spite of the fact that progressive men closely identified with the industry promised financial assistance—in one instance to the extent of furnishing a complete laboratory and in another to bearing part of the expense of the general administration—the question of ways and means proved an insurmountable obstacle.

Competition is on the increase and aggressive measures must be taken to meet it. The monopoly of trade

enjoyed by some of our manufacturers during the early stages of Canada's development is explained by the fact that the possibilities of the country were not adequately recognized. Now our business is on a more substantial basis and we must advance with the times or yield our part to others.

England is awakening to the importance of providing well-equipped schools for clayworkers. Germany, the leader in all spheres of technical education, has some half-dozen excellent schools, and our neighbors to the south recognize clayworking as a subject of university education. What is the attitude of Canada? In what category shall we place the achievement—or lack of achievement—of the last few years?

Now that the national association—thanks to its live president, Mr. Charles A. Millar, and others with whom he has associated himself—has shown itself capable of acting as well as talking, and of producing something more tangible than "papers" and menu cards, it will most certainly come into wider recognition and take a higher place among the trade and technical bodies of the Dominion. It is to be hoped that this will be but the first chapter of a long history of achievement and that before many years the facilities at the command of clayworkers throughout the country will be second to none. It is with the greatest pleasure that we extend our congratulations to the Association.

Increased Consumption of Water following Filtration

PROBLEMS encountered in the design, construction and operation of filtration plants have been the subject of no little discussion of late. The subject is brought to mind by a visit received last week from Mr. Allan Hazen, the New York engineer who designed the Toronto plant. We understand that Mr. Hazen is now arranging to proceed against the city to obtain compensation for its failure to entrust him with the extension of the plant and the discharge of its obligations in regard to the original design. Our Chicago contemporary, Engineering and Contracting, makes some interesting editorial observations respecting this plant, emphasizing particularly the unprecedented increase in water consumption which has taken place in Toronto since the fall of 1908 when the plant was designed. At that time the average total daily consumption of water was 30,000,000 Imperial gallons, a figure which increased to 44,700,000 Imperial gallons during the year 1912. To quote from our contemporary:

"We have before called the attention of engineers to the advisability of making allowance for the increased consumption of water following the installation of a filtration plant. This increase is due partly to new consumers, attracted by the improved quality of the public supply, and to the greater domestic use of water when mineral table waters are supplanted by the public supply. The increased consumption at Toronto is so enormous that it can only be partially attributed to the causes mentioned and, in fact, the high rate of increase in the consumption of water began at the time the filters were being designed which was three full years before the plant was ready for even intermittent operation. While evidences of progress toward the installation of filters can hardly be said to increase the use of water the actual installation certainly does. The new rapid sand filter at Minneapolis affords a good example of this. Designed of capa-

city suitable for a considerable period in the future it had not been in operation over six months before it was overloaded and extensions are now being planned. This was due, again, to a rate of increase in water consumption which hardly could have been anticipated. This tendency toward increased consumption following the introduction of filtration indicates not only the desirability of taking this probable increase into account in proportioning the plant, but also shows the importance of keeping meterage abreast of filtration; cities having filtered supplies should be fully metered as soon as practicable."

Montreal's Mishap

SHARP criticism of the Montreal Engineering Department has been heard as the result of a big break in the reinforced concrete conduit supplying Montreal with water. The break caused enormous inconvenience to the great majority of the inhabitants of the city, as they depended upon the conduit for the supply of water, and the break meant a discontinuance of the supply. Many industrial firms were also hampered, and the large shops of the C. P. R. at Angus were temporarily shut down. The conduit was constructed from plans by Mr. G. Janin, the city's chief engineer, in 1908, the contract being let to Mr. P. McGovern, of Boston, at a cost of about \$685,000.

The break which caused the water to be shut off was 60 feet long. The damage was repaired by cutting out the defective length of concrete and inserting steel pipes manufactured by the John McDougall Caledonian Ironworks Company, Limited, Montreal, as a rush order. These were joined, by means of brick and tar, to the ends of the concrete conduit, cement being also used in the interior. Unfortunately however, the job was not a success. The water was let in very slowly, but the pressure was too strong, and the joint of bricks, tar, and cement gave way, with the result that the supply had to be again shut off.

When the serious character of the first break became apparent the Controllers called in Mr. J. A. Jamieson, who conducted an examination of the interior of the conduit. The Atlas Construction Company were also called into assist in the work of repairing the concrete work.

Naturally, there were some strong opinions heard, and Mr. Janin was criticised adversely. Many outside engineers—some with expert knowledge and some without—gave their opinions as to the wisdom of constructing a concrete conduit, and it was said that under the conditions existing, concrete was a very unsuitable material for such a work. Others—notably Mr. C. E. Deakin, the contractor—were of opinion that the conduit was built as well as possible, and that the work on the aqueduct, which had been blamed for the break, would not, from a mathematical point of view, be considered as endangering the conduit in the least. The breakage was a pure accident for which no one could be held responsible.

The cause of the break, at the time of writing, had not been definitely ascertained, but it was held by many as being due to work on the enlargement of the aqueduct. It was supposed that the excavating machine encroached too closely upon the conduit and removed the supporting earth, with the result of a bad break.

At a meeting of leading citizens it was decided to secure the services of the best water engineer available on the continent with a view to an independent enquiry. The Controllers have also promised to conduct

a thorough investigation. It will be interesting to record the findings in due course.

The Engineer and the Accountant

IN the administration of large manufacturing plants and public-service corporations the combined abilities of specialists in engineering, law, production, salesmanship and accounting are essential to an efficient conduct of affairs, comments The Engineering Record. Between the first and the last-named class of experts a wide gap formerly existed, but the broadening tasks of each have brought the engineer and the accountant into closer relations, notably in connection with the work of commission regulation, the study of operating economies and the more extensive tabulation of construction costs. Around the conference table of the efficiency committee the accountant and the engineer come into especially effective contact.

A few specific illustrations of the sort of co-operation that is needful may be given. In practically all cases where a company appears before a State board seeking permission to issue securities it is required to present a list of the expenditures which it is proposed to capitalize, and usually at the stock or bond hearing following the petition a long exposition of these expenditures occurs. Often the lists are inadequate as to detail, and insufficient data are given to enable the commission to compare the actual or anticipated costs with similar expenditures elsewhere. It is most important that all legitimate costs shall be included in such exhibits, and here the accountant's broad knowledge of classifications and the segregation of items, combined with the engineer's understanding of what is essential in the way of physical data, may be of the utmost value. Unless an engineer has had a good deal of experience in court and commission work he is liable to overlook features of expense which the accounting expert will set forth at the outset. On the other hand, if the data are left for the accountant to compile he is almost sure to overlook some fundamental engineering dimension or quantity, without which no intelligent opinion can be rendered as to the propriety of the expenditure. In an extreme case it may lead to a scaling down of the amount permitted to be capitalized, which means that the burden must be borne out of immediate earnings by reduction of a hard-won surplus, or by slicing the depreciation allowance. The only safe way is for both engineer and accountant to go over exhibits of this character with the greatest care before delivering them to the executive or legal advisers conducting the company's case.

In valuation work the accountant needs the assistance of the engineer in the interpretation of items of plant expenditure, in the analysis of construction costs, and in the treatment of depreciation. The engineer's opinion as to the life of equipment and its fitness for service after a stated period must largely guide the accountant in his consideration of replacement costs, and the former obviously is the best interpreter in an operating organization of maintenance expenses. No accountant without engineering training or advice is in a position to judge whether repair costs are normal or abnormal in relation to the service conditions. The engineer, for his part, needs the comprehensive viewpoint of the student of figures in making sure that his subordinates keep adequate records and properly classify accounts so that unusual conditions can be

noted with the least possible delay. In the working out of cost systems these two classes of experts should confer at sufficient length to yield results of interest to the technical man no less than to the bookkeeper. Engineering advice may be as useful in the accounting department as in the purchasing bureau, and the recommendations of the accountant ought to make the work of the engineer easier if the classification adopted in a given company is the joint product of their labor.

It is surprising how difficult it is to maintain an accounting system which will give at short notice the variety of engineering or operating data which may be demanded in a special investigation, such as an analysis of wages and hours of service on a railroad; but this is a result of the expense of multiplying statistics which are really by-products of a company's bookkeeping records. There seems to be no limit to the amount of analytical study that can be applied to a payroll of this kind. In the arbitration of the hours and wages of street-railway employees now drawing to a conclusion at Boston, one of the most remarkable features of the inquiry has been the amount of extra work required from the auditing department of the Boston Elevated Company in the preparation of special information from its routine records to enable the cost and duration of platform labor to be thoroughly analyzed. The company's accounting system is exhaustive and scientific; but it is obvious that all the combinations of data which may be of possible engineering or operating use after being derived from such records cannot as a practical matter be maintained from month to month without undue expense. On such a system close relations between its engineering and accounting staff constantly tend toward the production of records of real value in the solution of special problems and toward the economy of time in studying the operation of the road from special angles of inquiry. In defining just what sort of statistical data are desirable for executive deductions there is a field for larger mutual service for the engineer and the accountant than has often been developed in the past.

One of the noticeable features of the large and more elaborate building undertakings of recent date is the increased use of terra cotta trim. Between terra cotta trim and the fancy finished brick and stone, other material formerly used extensively in face work is being crowded aside considerably. Sometimes an entire face is made of the terra cotta and at other times fancy face brick is used. It is terra cotta trim which breaks the monotony and puts in the trimming effects which harmonize beautifully with the other clay products. Terra cotta and face brick make an ideal combination in buildings big and little, and architects seem very favorably inclined toward terra cotta trim. This means that it is not only gaining ground but also that conditions are ripe for more extensive development in its use.

It is reported that the harbor of Dover, Eng., is practically derelict. The results of an extensive survey show a tremendous waste of public money. Although the harbor was completed only four years ago at a cost of £4,000,000, heavy silting, which experts attribute to the faulty construction of the entrances, necessitates an annual expenditure of £70,000. The result is that, although the harbor was built as a naval refuge, naval vessels rarely enter.

Engineering Topics In The Old Land

London Correspondent of The Contract Record Discusses the Proposal to Form a Canadian Institution of Municipal Engineers—The Need for a Central Authority to Control Municipal Borrowings in Canada—Civic Excursions

Special Correspondence of The Contract Record

London, December 23, 1913.

VERY considerable interest attaches here, in England, to the formation of the Canadian Institution of Municipal Engineers. Opinions are divided as to the desirability of affiliation to one of the English societies, and even if affiliation were deemed the politic course a further difficulty would arise. The profession of municipal engineering is represented in England by two bodies: The Institution of Municipal and County Engineers, with a life of some forty years, and the Institution of Municipal Engineers with a life of a little over five years. Six years ago the former body was lying moribund of sloth and inanition. Its rules, its methods of procedure, its administration, were obsolete. It was controlled by quite a small section of its members and no outsider could hope for admittance within the charmed circle unless he undertook to fight innovation and progress to the last ditch. The membership class was limited to those who held chief appointments, and there existed the anomaly that while the deputy engineer of a city such as Manchester, Liverpool, or Birmingham was ineligible for the class, the "chief" of the smallest district council—who might combine the offices of surveyor, sanitary inspector, petroleum inspector, rate collector and clerk, all for some £70 a year—was admitted without demur. The formation of the Institution of Municipal Engineers has changed all that, for the younger body is nothing if not progressive. It quickly realized the anomaly referred to, and it went further, for it recognized that gas, water, and electrical engineers to municipal authorities were municipal engineers equally with the men who controlled simply the highways and bridges, and sewerage and sewage works of the country. So as fast as the younger body progressed, introduced new methods, abolished anachronisms, and modifying obsolete procedure, so fast did the older body follow in its footsteps, accepting all and giving nothing, but none the less setting its house in order and taking on a new lease of life. That is precisely how matters now stand, the newer body constantly progressing, and the older body being as constantly forced by its members—by outside pressure, that is, for the circle still tenaciously cling to tradition—to adopt any and every measure. It has to be remembered, however—and the point is an important one—that the older body scores largely as regards prestige, while its roll contains the names of the greater proportion of the engineers to large cities and towns. Defections from its ranks have taken place among the smaller fry alone; but again, it must be remembered that the small chief or the deputy of today will be the big man of to-morrow, and the next few years will see a considerable levelling upwards in this respect. The Canadian Institution will do well carefully to weigh matters up before affiliating with either one body or the other; indeed it remains open to grave doubt whether affiliation would not be a most unwise proceeding. In any event, it would surely be wrong to take any such step until independent work-

ing had been tried. The English societies would necessarily be in friendly touch with the Canadian, and such little courtesies as exchange of proceedings and the extension of facilities to visit works (when members contemplated crossing the pond) would not be wanting.

Regulations of the Proposed Institution

It is customary, in drawing up the rules and regulations which are to govern a new society, first to obtain copies of those of existing societies of a similar nature. These are then submitted to the process known as "boiling down," the result of which has been exemplified by scores of instances. Experience has taught us that the happier the country the fewer its laws; hence the extreme anarchist (or no law) ideal. The really necessary by-laws for a professional society could be written on one side of a sheet of foolscap paper, whereas there is scarcely a body in existence that is regulated by less than some twenty printed pages. Is it too much to hope that the Canadian Institution will make its own regulations, and that it will in their making aim at brevity and clearness? The question of whom to admit and whom to exclude is always a difficult one in the case of a professional society, and the solution is to be found only in the admittance of all. Thus, in a municipal engineering society, all who are municipal engineers (in any capacity) and all who are in training for such a calling—whether as premium pupils or not—should be admitted, regardless of age, colour, or nationality. Such a society is only too often of the mutual admiration order, and a few top dogs rule the roost. Admit the rank and file, on equal terms if possible, and such a condition of things becomes impossible. The Institution of Municipal Engineers started with one class only—it has now three, and is proposing a fourth, and to that capitulation to the attacks of snobbery and dignity may be traced the slowness of its numerical progress during the past three years. A third point of no little importance is the position of the consulting engineer as an applicant for membership. A consulting engineer is not a municipal engineer in any sense of the word, even though he may call himself a consulting municipal engineer or some such hybrid name. He is out for business as much as is a manufacturer or contractor, and if the members of the last-named classes are ineligible for election there seems no reason why those of the other should be admitted. As a member of an institution composed of civil, mechanical or electrical engineers, the consultant has nothing much to gain. It is useless for him to canvass his fellows, for they are all out for work themselves. Turn him loose however among municipal engineers and his course is clear. He will utilise his membership for business purposes, and such being the case it might be argued that he should be refused admittance. But then, he is a very useful man, of considerable experience and free to speak his mind as he thinks fit, and so long as he keeps within decent bounds there is no reason why, on the other hand, his application should not receive full consideration. Men

styling themselves consulting municipal engineers should be sternly taboo, however, and the writer may be trusted to have good and valid reasons for such a strong pronouncement.

A Canadian "L. G. B."

The suggestion has been made that some central authority, like the English Local Government Board, should be formed in Canada, in order that "municipal borrowings could be sifted for the satisfaction of lenders." It is argued that some such authority, which would control municipal borrowings and supply information concerning securities offered, is much needed; indeed that some such organisation is essential to the maintenance of high municipal credit. It is felt here, in England, that the adoption of the suggestion could work only for good, and would do much to strengthen the advances made to the Canadian municipalities. The exercise of borrowing powers in England is regulated by the Public Health Act, 1875, and the regulations for the guidance of the Board are of a stringency which might not meet with favor in Canada. Too, the personnel of the Board here leaves much to be desired. As regards the first point, the following extracts from Section 234 of the Act will be of interest.

(1) Money shall not be borrowed except for permanent works (including under this expression any works of which the cost ought in the opinion of the Local Government Board to be spread over a term of years):

(2) The sum borrowed shall not at any time exceed, with the balances of all the outstanding loans contracted by the local authority under the Sanitary Acts and this Act, in the whole the assessable value for two years of the premises assessable within the district in respect of which such money may be borrowed:

(3) Where the sum proposed to be borrowed with such balances (if any) would exceed the assessable value for one year of such premises, the Local Government Board shall not give their sanction to such loan until one of their inspectors has held a local inquiry and reported to the said Board.

As to the personnel of the Board, this is composed almost entirely of ex-army engineer officers, whose knowledge of the requirements of a town is only too often of the vaguest. Military men are seldom a success in civilian affairs, and an officer whose life has been spent in, say, the construction of bridges in India is scarcely the man to serve as a final court of appeal in a town's requirements. There has been one notable exception in these appointments, but that official—an experienced municipal engineer—is now superannuated and none has taken his place. If Canada decides to appoint a board of her own, she would be well advised to be chary of introducing the military element. An engineering inspectorship is no sinecure, and only the best and most experienced men should hold a position of such national importance. A staff of men who are at least open to the suspicion of having failed at their own legitimate calling—else why the necessity for their retirement for civic offices?—cannot but prove a clog upon municipal enterprise, as the English municipalities have found to their sorrow on scores of occasions.

Civic Excursions

The City Board of Trade of Medicine Hat, Alberta, is wise in its generation. "Medicine Hat Day" should be a great event, and London and other great English

cities might do well to follow the example set. The writer records with shame the fact that however well he may "know his London," topographically and soci-ally, his knowledge of its "sights" is regrettably limited. Passing Westminster Abbey daily, he has not entered it since he was a boy in socks and bare legs. Passing the Houses of Parliament daily, he has never entered them at all! The Tower of London is a forgotten memory, and his last visit to St. Paul's Cathedral was for the purpose of sheltering from a shower of rain! The idea of "an excursion of citizens to view their own city" is a great one, and especially perhaps as regards the industrial side, for it is true that "many people, even business men, do not realise the importance of industrial development." Visits innumerable are paid by London school children to the great sights, but with the closing of the school gates behind them interest seems to cease. The industrial and manufacturing centres are neglected in toto, at all ages and by all classes. Perhaps London may be fired by the example set by Medicine Hat. That she could gain much by so doing is beyond dispute.

Water-Tightness of Untreated Concrete

Experiments on the water-tightness of plain, untreated concrete are being carried on in great detail at the College of Engineering of the University of Wisconsin. The series is not completed but it is stated that those tests which have been made show that good results are obtained if the concrete remains in the mixer from two to three minutes when dry materials are employed, but that for cases where the sand and gravel or stone are damp a considerably longer time is required. Therefore the use of wet sand should be avoided if possible. The experiments showed that mixtures consisting of 1 part of cement, 1½ parts of Janesville sand of the torpedo grade, and 3 parts of Janesville gravel, when mixed to a wet consistency, are impervious to water when subjected to a pressure of 40 lb. per sq. in. Mixtures as lean as 1 part of cement to 6 parts of gravel (a graded mixture) have been made impervious at high pressures by using care in proportioning the amount of water and in mixing the batch. The specimens used in making these tests are cylindrical in form and so made that the faces of the cylinders, which are 13½ inches in diameter, are exposed to the predetermined water pressure. The thickness of the concrete through which the water must pass can be varied from 4 to 18 inches. Ample provision is made for cleaning both faces of the cylinder before placing it upon the testing apparatus. The department is also studying the effect of varying the percentage of cement and water, the gradation of the sand and gravel, the proportioning of the mixture, the thoroughness of mixing, on the hardening of the specimens.

A suggestion for an innovation in civic construction work has been made to the Winnipeg Board of Control by W. G. Douglas. He believes that by manufacturing cement curbing for street paving at the city shops during the winter months much time could be saved when construction work starts next spring. Experts have declared the scheme to be quite feasible, and the controllers favor it on the ground that it would give a good deal of work during the winter months to men who would otherwise be out of employment. It is even believed that the curb could be made at the shops quite as cheaply as on the streets.

Constructional Features of the New Dominion Bank, Toronto

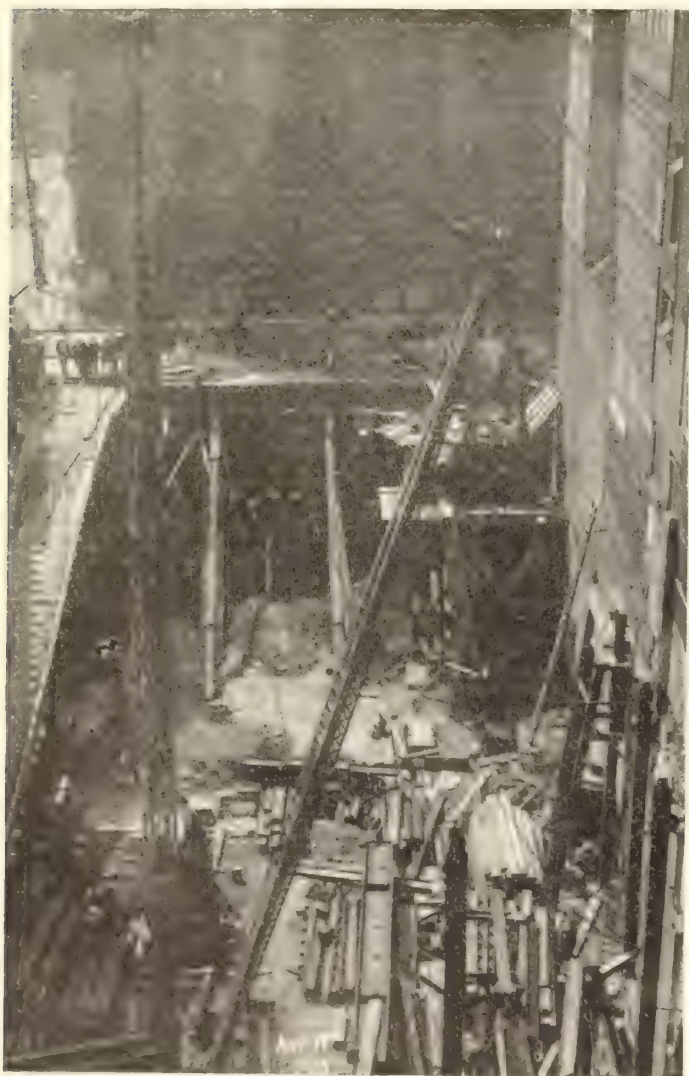
Progress Article

IN the construction of the Dominion Bank building, Toronto has a new record for the rapid erection of structures of this type, and, what is more, it has a building which in point of design and structural finish sets a new standard of attainment for the expenditure involved.

The site upon which the building stands, at the corner of Yonge and King streets, may be said to be the hub of Toronto's commercial activity, and the new structure will prove a worthy headquarters of the progressive interests responsible for its erection. With a frontage of 168 feet on Yonge street and 75 feet on King and Melinda streets, the building consists of twelve floors and roof rising to a total height of 186 feet, it being ten storeys above grade. Although it is several floors less than the headquarters of the Canadian Pacific Railway on the opposite corner, which is claimed to be the highest office building in the British

Empire, there is only a difference of about fifty feet in the two structures.

The building, which has a sub-basement and basement, is of granite to a height of about fifty feet and of terra cotta above. The style of architecture is a free adaptation of the Italian Renaissance. The structure is of skeleton steel construction with tile arches and is done in fireproofing throughout. The sub-basement was excavated to a depth of 38 feet below the street level and solid rock was encountered at practically the position of the grillage beams. These beams were delivered in July as fast as excavation permitted and the first columns were erected on August 19. Included in the sub-basement, mezzanine floor and roof, there are fourteen tiers of beams and girders supported by fifty-nine columns. Some idea of the dimensions of the building may be gathered from the fact that in the erection of the bank about 2,300 tons of steel were used.



First column of steel work in course of erection (August 19). One of the derricks is seen in position in the basement. Part of the work under way in excavation for the grillage beams and the Melinda street end of the building.



From the above illustration it will be seen that the steel work has been completed to the tenth floor and is ready to receive the last tier of columns. The commencement of the stonework on the fourth floor (Oct. 21) is also shown.

The steel for this structure was put together in just sixty-four working days—the final erection of the roof beams being completed on October 31 and the rivetting and painting of the entire steel work finished on November 10. This is an achievement of note. The steel contractors state that had it not been for occasional delays in transportation of material their portion of the work could have been completed in still less time.

Among the illustrations in this article is one showing the foundation as it appeared on August 19 and another the completed steel skeleton construction and a large portion of the granite work in position on November 10. Up to the top of the second or banking floor the steel work was fabricated from stock at the Toronto plant of the steel contractors, while above the second floor it was of "Bethlehem" construction for the columns with "Carnegie" beams specially rolled for floors. For the work of erection two steel guyed der-

ing of shields set very attractively on all three elevations of the bank. Circular columns beginning on the ninth floor and artistic railwork running right around the building are also attractive features. It is the intention to erect further ornamental work above the roof, next spring, by which time the building will have approached completion.

Interior Features

The interior of the building promises to excel most other buildings in the city regarding equipment and finish. The ground floor will be occupied by the Savings Bank department. Immediately above it is the main banking room floor, which will be approached by a monumental staircase of marble, fitted with bronze balustrade. The main banking-room as well as the savings department will be lined with marble from floor to ceiling. The particular kind of material to be



This photo shows the wind-bracing connecting the beams and columns, and the starting of the walls at the second floor. The last beams have been placed in position and the derricks removed from the top (October 31).

ricks with eighty-foot masts and seventy-three booms were utilized, the derricks being raised two floors at a time as the building progressed.

The granite Doric columns at the entrance are three feet in diameter and twenty-five feet in height. Extending to the Mezzanine floor, the columns are an ornamental feature which will add greatly to the general attractiveness of the picturesque granite front. The detail of the three facades of the building is simple but at the same time very attractive. Architectural terra cotta has been used in the entire exterior of the building above the granite work, in all about 800 tons of the material having been utilized. The floor arches between the beams are of terra cotta fireproofing construction. The terra cotta is a light grey color, speckled and matt glazed, the ornamental features consist-



Entire steel work finished and nearly all granite in position (November 10). Stonework incomplete at third floor to facilitate handling of material and protect exterior ornamental work.

utilized for this purpose has not yet been decided upon. The ceilings of both banking-rooms will be of ornamental plaster and the counters lined with marble, with grilles erected for a certain distance above them as is the custom in banking offices. The floors of both banking-rooms will be laid in marble tiles. From the second to the seventh inclusive the floors are divided for office accommodation and will be sub-divided to suit tenants. On the eighth floor there will be dining-rooms and kitchen for the use of the banking staff.

The ninth floor will be the Head Office of the Dominion Bank. It is twenty-two feet in height, lighted from the centre by ceiling light and surrounded by a mezzanine floor. Needless to say this section of the building will be in every respect worthy of the purpose for which it is intended. Lavatories for the head

office staff will be located in the attic, as also the janitors' quarters.

The building is equipped with six passenger elevators of the Otis-Fensom type and there will also be five lifts descending to the vaults. A complete system of air-washed artificial ventilation will be installed, while the building will be steam-heated throughout. All the elevators will run to the basement which contains the safety deposit vault which is reached from the savings department. All the elevator hall walls will be lined with marble. The elevator grilles on the ground and main floors will be of bronze, those on the upper floors being of wrought iron. Lavatories for the banking-room staff will be located in the basement and others will also be provided on every office floor. The heating plant, boiler and machinery room are located in the sub-basement.

When completed the building will have involved an



Dominion Bank, Toronto—Exterior work practically completed (November 30)

outlay of about one million dollars and it is expected that it will be ready for occupation before the end of 1914.

The building was designed by Messrs. Darling & Pearson, architects, Toronto, with Messrs. Harkness & Oxley as consulting engineers. The general contractors are the Canadian Stewart Company, Limited, the work being under the supervision of Mr. G. Griest, manager of the Toronto office. The entire steel work was supplied and erected by the Canadian Allis-Chalmers Company, Limited, Toronto, the shopwork and erection being under the immediate supervision of Mr. J. L. Brower, manager of the bridge department of the company. The granite was supplied to the order of the general contractors by the McIntosh, Beebe Granite Quarries, Quebec. The Northwestern Terra Cotta

Company (for whom the Black Building Company are the Toronto agents) had the contract for the architectural terra cotta. The fireproofing was supplied by the National Fireproofing Company. The high-grade face brick was furnished by the Kittanning Brick Company, whose Toronto representatives are Messrs. Scott, Hammond & Pratt, Limited. The Don Valley Brick Works, Toronto, supplied the hollow brick and the Port Credit Brick Company the common brick. The boilers, etc., were furnished by the John Inglis Company, Toronto. The ornamental iron work was supplied by the Architectural Bronze and Iron Works, Toronto.

Designing for the Future

TO point out the danger of determining types of structures or processes years before they are built is not common. But not infrequently portions of work—foundations, for example—are put in when the primary installation is made, leaving the completion of the work until such time as increased capacity is required. In some lines advancement is so rapid that installations only a few years removed from each other in date of construction are radically different in type. The later installation is naturally the more efficient, and when the increase in efficiency is very marked it is sometimes advisable to scrap the earlier equipment, no matter what its remaining life. While these are elementary considerations, recent occurrences give them point. Advances in hydro-electric practice have been so rapid that even before the great Keokuk plant was put in operation certain features of the equipment had become obsolete. More recently it has been rumored that in a large installation where foundations were prepared for double-runner wheels, single wheels will be used instead. The moral is that in building any portion of a future structure, whether in hydraulic or other branches of engineering, the work should not be carried beyond the simplest stages. Just how far it is advisable to go must depend entirely upon the judgment of the engineer in charge and his knowledge of the history of the art. In some lines there is a fair degree of certainty that the general types now in use will be adhered to for some time, while in other branches practice is in such a state of flux that there is possibility that even the most simple foundation work will need to be destroyed when additions are necessary. This factor has risen in connection with the design of the terminals for the New York State Barge Canal. It was concluded that nothing but the docks should be constructed at the present time, leaving the design of superstructure for a later date, so that it may be made to conform to whatever type of handling device is proved to be most economical by the time the terminals are to be put in operation. Again, in the papers on the Imhoff tank published in this journal recently the same idea was emphasized. The advances in sewage disposal are so rapid that the construction of tanks which are not needed for four years or so is hazardous. The point is well worth bearing in mind when conditions dictate the advisability of putting in some portions of a structure not needed at the present time. There is danger of forcing the use of equipment or processes which will be obsolete a few years hence, or of losing large sums in discarding or removing the partly constructed work to make way for the more efficient methods.—Engineering Record.



New Residence For the Lieutenant-Governor of Ontario

The above is a front view of the attractive residence now being completed for the Lieutenant-Governor of Ontario. In point of design and construction the building possesses a number of features of outstanding interest, but although this is a public edifice, built with public funds, the most unreasonable reticence has been shown by the government officials, with the result that the accompanying pictures and details, meagre as they are, constitute practically the first authoritative article on the work published.—Editor.

CONSTRUCTIONAL operations on the official residence for the Lieutenant-Governor of Ontario have reached that stage when a description of the main features is timely. Located in one of the most inviting suburbs of Toronto, Chorley Park, and being within easy access of the city, the official home of the Lieutenant-Governor will rank second to none in point of architectural gracefulness and beauty of general setting. The photographs reproduced herewith afford an idea of the building as it now appears, the main as well as the side entrance being shown to advantage. The house is in the French Chateau style of architecture and is faced with grey

Credit Valley coursing with cut stone trimmings of grey sandstone.

The interior is fireproofed with porous terra cotta, consisting of cambered arching for the floors and terra cotta partition walls. All the beams and columns are protected with terra cotta, the entire roof being covered with "book tiles."

There are nineteen rooms in the basement, twenty-four on the first floor, twenty-four on the second floor, and twelve on the third floor. The total number of bedrooms situated on the two latter floors is thirty-six. A bathroom is connected to each. Of the rooms in the basement and on the first floor the secretary's



Lieutenant-Governor's residence, Toronto. View from southwest.

and waiting rooms, the Lieutenant-Governor's office, the state and private dining rooms, the kitchen and servants' rooms, are on the west side. On the east side are the reception room, drawing room, writing room, living room and palm room. The rooms on the first floor are sixteen feet high from floor to ceiling, with the exception of the ballroom which is 25 feet 6 inches from floor to laves. The porte cochere is of cut stone. There are terrace bays to the living room on the east and to the state dining room on the west. The palm room is of cut stone on three sides and overlooks the Don Valley on the east. On the east side of the ballroom there is an alcove, thirty-two feet by twelve

feet, with a casement opening on to the verandah. The latter is of cut stone with massive stone columns and monoliths, the columns in one stone each weighing three tons. The ballroom has an apsidal end to the north and the billiard room situated on the second floor over the dining room faces towards the west. The residence is expected to be ready for occupation in 1915.

The contractors who have been working on the building up to the present are:—Messrs. F. Holmes & Sons, cut stone, brickwork and fireproofing; Messrs. Douglas Bros., roofing; Messrs. Canada Foundry Company, Limited, steel; Messrs. Purdy, Mansell, Limited, plumbing.

Explosives and Their Use in Excavation Work for Buildings

By C. E. Anderson, New York City

OF the difficulties encountered in building and construction work, perhaps the most difficult and at the same time least understood operation is the removal of rock from a building site. Such work is often let to some sub-contractor or is handled in the best way known to the contractor, which in many cases turns out to be a very expensive operation. The blasting of rock is a science which can be learned only by experience; but even experience does not teach everything about the subject, and most contractors must gain a knowledge of this subject without seeing work done by the best powder men. The following article considers some of the essential points relative to work of this kind, and also gives some of the characteristics of explosives.

Explosives and Their Characteristics

Explosives may be divided in a general way into two classes: low explosives, such as gun-powder; and high explosives, commonly known as dynamite and sold for different purposes under various names such as gelignite, gelatine dynamite, giant powder, forcite, etc. Gunpowder is composed of siter, sulphur and charcoal. Dynamite is made in a number of different strengths; that known as 40 per cent. dynamite is the most commonly used and is comparatively safe to handle. It is composed of nitroglycerin, or some similar compound, mixed with other compounds and wood-pulp. Great care must be exercised in using gunpowder, and no light should be brought near it, as the dust raised in loading a hole will sometimes communicate flame to the powder. The writer has seen men burned out of all recognition through carelessness in this respect. Dynamite may be used with comparative safety if it is carefully and sensibly handled.

In handling dynamite certain precautions must be taken, and some of its characteristics, which are not always understood, will be mentioned. Nitroglycerin freezes at a temperature ranging from 42 to 46 deg. F. Dynamite is more sensitive to friction when frozen, and the cutting or scratching of frozen dynamite is likely to result in a serious accident. Moreover, it can not be properly detonated when frozen and must be thawed before being used. Too much heat or moisture is also injurious to dynamite, causing it to "leak." It may soak into one end or one side of the cartridge, where it becomes highly concentrated, or it may even soak into the box. The writer has heard of empty

dynamite boxes exploding when burned, having absorbed some of the nitroglycerin. Dynamite which is in this condition can be detected because of the "soggy" feeling of one end or one side of the cartridge. Such dynamite should be carefully handled, as it is much more sensitive to shock than if in good condition. Frozen dynamite should be carefully thawed. Dynamite which has "leaked" should be destroyed by burning in a safe place, setting the sticks end to end before lighting. Cartridges should never be thawed by steam or hot water, as the water will tend to replace the nitroglycerin. Thawing by placing near a fire is also dangerous. The safest method is to place it in a box beneath a pile of green manure or spread it out in a warm room. After thawing, the cartridges are likely to leak, and should be carefully examined before using.

Use of Explosives in Basement Excavation

The plan and section in Fig. 1 show a good method of drilling the holes for removing rock from a basement excavation. In Fig. 1 (a) the holes are shown by heavy broken lines and the depth and limit of the excavation are shown by the light broken lines.

In blasting soft rock or shale it is customary to use powder in preference to high explosives, since it is slower in its action. If dynamite is used in soft rock it usually blows out a small crater-shaped hole, for the reason that the action is too rapid to communicate itself to the surrounding rock. On the other hand, if powder is used the action is slower, the force exerted will be communicated to the surrounding mass, and more rock will be loosened. If the rock is hard it is better to use dynamite, as it is necessary to shatter it with a sudden shock.

Powder can be used to advantage in quarrying stone which is to be used in masonry work. In this case a line of wedges is driven, together with a few bore holes at regular intervals, along the line where it is desired to split the rock. After the wedges have been driven in solid, a few light blasts with black powder will split the rock along the desired line.

It is seen from Fig. 1 that holes Nos. 1, 2 and 3 form a triangular or wedge-shaped section. If these three holes are fired at the same time they will start the excavation by blowing out this wedge-shaped piece. It would be better in starting to first blow holes Nos. 1a, 2a and 3a, or if an electric blasting machine is

used the three center groups could be "pulled" at the same shot. This would loosen the material shown inside the curved dotted line on the plan. After the loosened rock had been removed the rock at the sides could be blasted from the two groups of holes Nos. 1, 2 and 3, and Nos. 1d, 2d and 3d, which now could be fired without danger of breaking back outside of the excavation line. The remaining holes could then be fired in groups; the number fired at each shot depending upon the method of firing and upon other conditions. It is best in each case to pull the center holes first, leaving sufficient space to shoot the side holes. The spacing of holes is largely a matter of judgment; in general, the distance from the hole to the face of the rock which is to be blasted should be about three-quarters of the depth of the hole. In deeper holes the "burden" would be less in proportion to the depth of the hole. Figure 2 shows the manner in which the rock breaks under a high explosive and indicates the proper depth of hole. The distance W , which represents the burden, is three-quarters of the distance from the center of the charge to the top of the hole. The hole shown in Fig. 2 represents a "sprung" hole, the charge being entirely in the "sprung" or enlarged portion of the hole. If the face cd of the rock is free, as indicated by the drawing, the shot will break out a crater-shaped section, indicated by the lines ad and ef , carrying with it the shoulder above. If, however, the hole is merely drilled to the floor of the excavation, represented by ab , the force of the blast will be reflected upward from the floor and will break out a section included between the lines eg and ak , which will also carry with it the shoulder above. This explains why the rock will fly more if the hole is loaded too high. If the hole is not sprung, and is loaded up to the point h , the rock will

the hole is drilled too deep the charge blows out a crater-shaped section of rock at the bottom of the hole, and the shoulder above this crater is broken off or is left hanging without being shattered. It is then necessary to mudcap the big pieces in order to make them small enough to handle. By mudcapping is meant the placing of several sticks of dynamite on top of the boulder which is to be broken, covering them with mud or clay and firing them. In the west, this is called a "dobe" shot. A shot of this kind is occasionally necessary, but if it occurs too often the depth

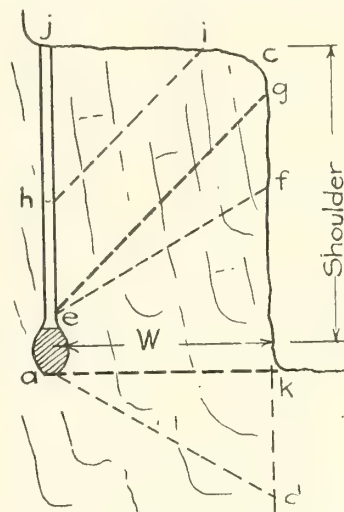


Fig. 2—Lines along which rock will break with proper depth of hole.

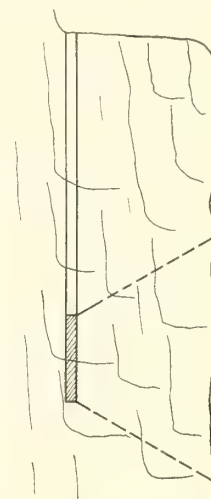
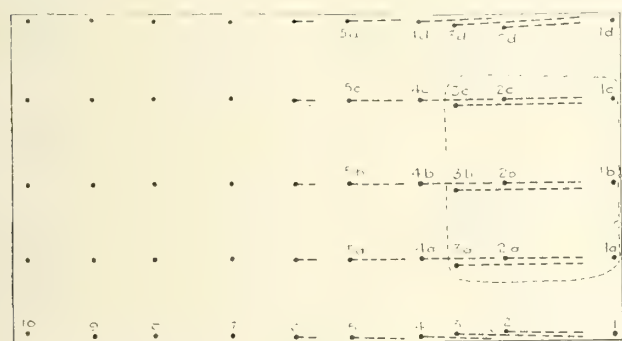
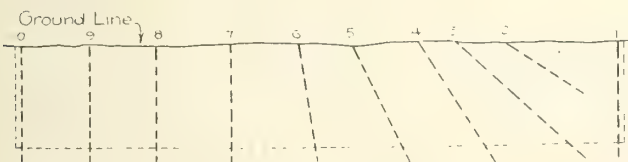


Fig. 3—Action of a high explosive in a deep hole.



(a) Plan



(b) Section

Fig. 1.—Plan and section showing method of placing holes for excavating rock from building site.

break as indicated by the line hi . It is evident that the distance from h to the top of the hole does not leave enough rock on top of the blast to resist both the direct force of the blast and the force reflected from the floor. Thus the portion hij is broken by the direct strength of the blast and is then met by the upward rebound, and the broken pieces are thrown into the air. Figure 3 indicates the action when the hole is drilled too deep, and explains why in some cases it is so often necessary to "mudcap" or "dobe" large pieces on some work. If

of the hole should be changed in proportion to the size of the burden.

Kinds of Drills.—Figure 4 indicates the best shape for drill bits. The hand drill is forged crescent-shaped and is tempered to a "grey temper." The drawing also shows a machine drill bit and indicates the right and wrong way to sharpen a drill bit. If incorrectly sharpened, the cutting edge wears down faster than the shoulder, and the drill will stick in the hole. If a shoulder is left on the drill it should be tapered to a smaller gauge than the cutting edge. In tempering drill steel the chisel bit is formed and the steel re-heated. It is then plunged in water for a moment and the edge scraped clean on a stone. The line of colors advances toward the point of the drill and as the edge turns yellow the bit is plunged into cold water.

Method of Placing and Firing the Charge.—In blasting, one of the axioms of the powder man is, "Don't let the powder come up in the hole." The place for the charge is in the bottom of the drill hole. There are several reasons why this condition should be met. One of them—and one which concerns the man who is blasting near other buildings—is that if the charge extends too high in the hole it is likely to cause small pieces of rock to be blown a long distance. The best way to keep the charge down is to "spring" the hole. This consists in enlarging the bottom by exploding a small quantity of dynamite in the hole, with little or no tamping. This enlarges the bottom of the hole, and the operation may be repeated until there is room for the charge. When the shot is fired the rock is simply lifted and drops back into the hole very little or none of it being scattered. Care should be taken not to spring the hole too much, as the effect may be lost. After once springing a hole it must be allowed to cool thoroughly before any powder or dynamite is put into

it. Loading must be done with a wooden tamper. Steel bars should never under any circumstances be used for tamping. The material used for tamping should be free from small pieces of stone or other hard material which might produce sparks or damage to the fuse. Moist clay is the best material for tamping, a paper wad being placed between it and the powder. The tamping should be firmly rammed into place. In loading with powder, first spring the hole and then pour in the powder until it begins to rise in the hole, placing the primer as nearly as possible in the middle of the charge.

The best method of ignition is by means of an electric fuse, although safety fuses and blasting caps can be used in the same way. The primer for a powder charge should be made into a cartridge with the cap or fuse in the center of it. This cartridge may be formed by wrapping paper around a round stick, and fastening the loose ends of the paper. When the stick is withdrawn, it leaves a paper cylinder into which the powder is poured. The ends are then folded to enclose the powder. It is not necessary to use strong caps or fuses with black powder. When powder, fuse and cap are used it is necessary to place the primer or cartridge containing the cap at the top of the charge, otherwise the fuse will burn the powder before the spark reaches the cap. The end of the fuse is first placed in the end of the cap (with the fuse not quite touching the composition), and the cap is then crimped tightly to the fuse with a cap crimper. Obviously one should not bite the cap to crimp it, although this is sometimes done. The cap should then be placed in the end of the cartridge, as shown in Fig. 5. Figure 6 shows the proper method of inserting an electric fuse in a powder cartridge.

By far the best method of firing a blast is by means of an electric blasting machine. By electric firing, the

being known as the two-post and the other as the three-post machine. The three-post machine is used to fire a larger number of holes.

In loading with dynamite, the cartridges are slit on the side with a knife in order that they will pack tightly in the bottom of the hole. Each cartridge must be tamped firmly into place. The primer is placed in about the middle of the charge and the loading is continued until the charge begins to rise in the hole. The charge then should be tamped with clay or with some other similar material, making sure that it is free from loose pieces of stone or hard particles. In placing the priming cartridge containing the electric fuse, the cart-



Fig. 5.—Method of inserting cap and fuse in cartridge.

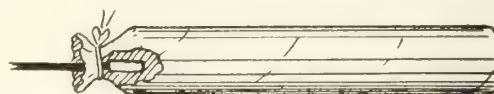


Fig. 6.—Method of inserting electric fuse in cartridge.

ridge should be placed at the end of the loading stick and pushed carefully into the hole. Care must be taken to keep the wires straight and at the side of the hole so that they will not be injured by the tamping. The approved method of priming a dynamite cartridge is as follows: With a pointed stick about the size of a lead pencil make a hole in one end of the cartridge; then insert the electric fuse, bending the two wires carefully over the end of the cartridge and tying them thereto with a string, as shown in Fig. 6. In tamping, press the material down gently for the first 8 ins.—after that more force may be used. When a bore hole has missed fire, drill a new one about 2 ft. from it, but do not attempt to draw the old charge. In blasting with dynamite it is necessary to use a double-strength cap or fuse.

An electric fuse consists of a copper shell, inside of which there is a chamber containing a charge which consists mainly of fulminate of mercury. The shell has a corrugation through which the copper fuse wires enter. These wires are insulated except at the places where they enter the corrugation and are held in place with sulphur cement. The ends of the fuse wires inside the shell are connected with solder to a small platinum wire, or bridge. The fuse is exploded by the passage of an electric current through the wire, which heats it to redness. An ordinary fuse of this kind can be used under water, but special caps covered with gutta-percha are made for submarine work.

The electric fuses are connected with wire when several are fired at the same time. This wire is sold in spools and should never be of smaller size than the fuse wire to which it is connected. A "leading wire" is run from the blasting machine to the location of the blast.

The following general directions are given by the Du Pont Powder Company for blasting by electricity:

Drill the number of holes desired to be fired at one time, the depth and spacing of the holes depending upon the character of the rock, size of drill holes, etc., the blaster of course using his judgment in this matter. Load the holes in the usual manner. Avoid taking hitches in the electric fuse wires, as by this very common practice the insulation of the wires may be injured, and the current of electricity may pass from one wire to the other without passing through the cap,

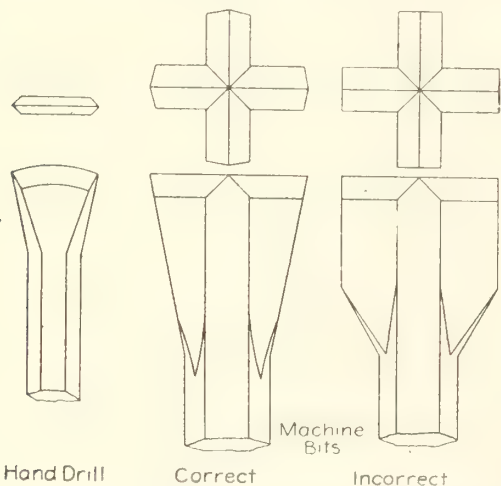


Fig. 4.—Correct and incorrect methods of sharpening drills.

full strength of the explosive is developed, and as several holes can be fired at the same instant less explosive is required, as well as fewer holes. There is also eliminated the danger of a hole hanging fire and going off at an unexpected moment. The blasting machine is operated by pushing down a handle which operates a dynamo. This creates a current which by means of the connecting wires is communicated to the fuse. Blasting machines are rated to fire ten, twenty or more holes, i.e., they will fire that many caps. If more than one cap is used in a hole, as is sometimes done, the machines will of course fire a lesser number of holes. There are two kinds of blasting machines in use, one

hazarding a miss-fire. The electric fuse is best placed when in the center of the charge. In tamping the hole, great care must be taken not to cut the wires nor to injure the cotton covering the fuse wires and not to pull the electric fuse out of place. Allow at least 8 ins. of fuse wire to project above the hole to make connections. When all the holes to be fired at one time are tamped (and one fuse only is used in a hole) separate the end of the two wires in each hole, and by the use of connecting wire, join one wire of the first hole with one of the second, the other or free wire of the second with one of the third, and so on, leaving a free wire at each end hole. When two electric fuses are used in each hole, connect one wire of each of these two fuses together and then connect the holes by the remaining wires of the fuses, as would be done when connecting only one fuse in each hole. In other words, connect the fuses in series throughout. All connections should be made by twisting together the bare and clean ends; it is best to have the joined parts bright. Scrape off the cotton covering at ends of wires to be connected, say for 2 ins., then scrape the wire until it is bright. This makes a clean, fresh connection. Bare joints in wire should never be allowed to touch the ground, particularly if the ground is wet. This can be prevented by placing dry stones under the joints. Insulating tape is also furnished for waterproofing bare joints. The charges having all been connected as directed above, the free wire of the first hole should be connected with one of the leading wires and the free wire of the last hole to the other of the two leading wires. All being ready, and not until the men are at a safe distance from the blast, connect the leading wires, one to each of the projecting screws on the front, side, or top of the blasting machine, through each of which a hole is bored for the purpose, and bring the nuts down firmly on the wires. Now, to fire, take hold of the handle for the purpose, lift the rack bar (a square bar, toothed on one side) to its full length, and press it down quickly with all the force possible, bringing the rack bar to the bottom of the box with a solid thud. Do not churn the rack bar up and down. It is unnecessary and is harmful to the machine.

Power of Explosives.—With reference to blasting, there are three degrees of power exerted by explosives, depending upon the nature of the explosive or upon the conditions under which it is used. An understanding of this will aid in getting the best results. The explosion of gunpowder is merely a rapid combustion. If gunpowder is lighted in the open it simply flares, or burns without exhibiting any great amount of force. If, however, it is confined and ignited its combustion causes an explosion, because the expanding gases meet with resistance and are obliged to overcome it in order to expand. The difference between combustion, explosion, and detonation may best be illustrated by means of dynamite. If a stick of dynamite is ignited in the open it will burn rapidly without exploding and will produce a thick poisonous smoke. If breathed in quantities this smoke will cause illness or even death. If a stick of dynamite is confined and ignited it will explode but will produce the same fumes. A weak cap will explode dynamite with considerable force, but the same fumes will be produced to some extent. On the other hand if a triple-strength cap is used the dynamite will detonate with great violence, producing little or no smoke. The smoke in these cases might be said to represent lost or wasted energy. Dynamite must be detonated with a strong detonator to get the best results. Firm tamping

is necessary for the strongest detonation, as any air spaces permit the gases to expand without doing any useful work.

Instructions For Use of Explosives

Finally, a few words of caution in the use of explosives will not be amiss. Do not smoke while handling explosives or handle them near an open light. Caps and electric fuses are extremely sensitive; do not carry them in your pockets and do not store them in the same building with explosives, and never try to open or tamper with a cap or electric fuse. Never tighten a cap around a fuse by biting it with your teeth. There are crimpers made for that purpose. Do not handle or store explosives in or near a residence. Always give a hole time to cool after springing it before loading. Use only a wooden rod for tamping. Take plenty of time before you approach a miss-fire if you are using a powder fuse, for it will sometimes hang fire and go off at an unexpected moment. Do not try to draw out a charge which has not been fired. Drill a hole near it and fire the new hole. This will also explode the old one. Use only one kind of an explosive in a hole, unless you are using one as a primer for the other; as some explosives are quicker than others and the effect of the slower one will be practically lost, the quicker one opening cracks in the rock through which the slower one blows out. Always use double-strength caps or electric fuses when blasting with dynamite. When putting in the primer with the tamping stick do not tamp, but press gently until it touches the main charge. Do not load holes too high, as it gives poor results and is dangerous. In general, if explosives are carefully and sensibly handled they may be used with comparative safety.

Renewing Wood-Stave Pipe

IN January, 1901, the city of Seattle, Wash., put in service a 42-in. wood-stave pipe 22 miles long, which was built the preceding year to bring the city's water supply from the Cedar River. The staves used in the pipe were 2 x 6-in. native Douglas fir, dressed on both sides, cut to radial lines on the edges and cinched together with individual steel bands. After seven years of service some staves began to show signs of failure due to decay, and since that time the pipe has required some repairs each year. As much as 500 to 1,500 ft. has been entirely renewed at a time in some seasons. It is not planned to replace all the remaining original parts of the line at any one time; instead, the renewal will be made little by little, it is reported, replacing only those sections which manifest serious decay.

The rate of decay is said to vary less in different sections of the pipe as a whole than it does in the individual staves. In some cases a perfectly sound stave is found alongside one entirely decayed. The results of erosion also varied with the individual staves, the slash-sawed staves showing considerable wear at points where edge-sawed staves were practically intact. In general the quality of the timber used is thought to have had more to do with the durability of the pipe than any other cause.

Experience with this pipe, water department officials say, indicates that it would be possible to materially increase the life of such pipes by carefully selecting the timber with particular reference to soundness of fibre and conditions of sap.

Economies in Contracting Operations

Abstract of an Interesting Article (by Dr. Sachs in Le Ciment Arme) Devoted to a Consideration of How Forms and Form Work should be Accounted for in Reinforced Concrete Construction

THE reinforced concrete industry presents some difficulties, at least in number, unknown to others; the manufacture of artificial stone alone offers similar difficulties, due to new equipment, the need of which is not felt, to technical ignorance and to lack of business knowledge. These things are not the cause of lack of success on the part of contractors in reinforced concrete, except in the case of small operators, who have permitted themselves to be drawn into undertaking this special work and have hastily gone out of the business, having burned their fingers. It may be stated that actually, in Germany, the great bulk of work in reinforced concrete is undertaken by firms with large capital, directed by engineers who are specialists, and by experienced business men. This is all the more reason for surprise at the frequent errors into which they fall. The matter is not to be explained by the closeness of competition. No one complains of lack of business, but it is nevertheless true that firms foolishly run after new business and in order to secure it do not hesitate to allow themselves to bid at prices which are not sufficiently profitable. Since the management cannot be accused of lacking technical and business knowledge, we are led to think that, if they appear to overlook the fundamental principle of all business dealings, "rather no business at all than business done at a loss," it is because they do not take into account real cost prices or they do not have a sound accounting system. A few examples will demonstrate our thought and the importance of errors which are committed.

There are some firms which by reason of their professional ability and the important undertakings which they have carried to a successful issue have acquired such a reputation that they are given new work without having it submitted to competitive bidding. These firms, being favorably situated and not being obliged to count every penny, can satisfy every rule of the art.

Price-Cutting Competition Undesirable

But, except in these unusual cases, work is generally let to competitive bidders. It is admitted that of late years some reforms have been introduced in these matters, at least so far as municipal undertakings are concerned.

The general objection to the system of awards and the abuses to which it gives rise, together with a clearer intelligence on the part of those who have the interests of good construction at heart, have largely served to improve the old customs. In many localities it is pleasing to note that the specifications are now more just to the owner and to the contractor and if this tendency is not more general, the delay must be ascribed to the difficulty of reconciling the interests of these two. There is a marked tendency to do away with the obligation to award the work to one of the three low bidders, since experience has shown that the principal factor of success of the enterprise is the integrity of the man who undertakes the work.

Unfortunately, these considerations are taken into

account by few only, and there may be noted in the majority of tenders some striking differences between the high and the low bidder. These might be explained by the newness of the industry, comparing them with the slight differences noted in bidders on construction in metal, where the raw materials are priced on bases which vary very little. In steel construction, the conduct of the work plays an important role and the price of only a few pieces of work can be definitely fixed by regulation. The slight variation in the bids would result from the long experience acquired by iron and steel contractors, which permits them to know within close limits cost prices and miscellaneous expenses. There are expenses which constructors in reinforced concrete do not take into account and among the latter is that of form work, which will be taken up later.

Dangers of Sub-contracting

There is one serious fault of certain managers, that of confiding their work to general contractors. There should be every confidence in the special training of the firm making the tender, that it limits its activities to concrete work. It is true that the general contractor makes easy the work of the managers dealing with him. But is there ever a contractor who knows all branches of construction equally well? No. So he goes to sub-contractors for carpentry work and masonry, whom he puts in competition and from whom he secures close figures, though at second hand. The dangers of such a method are obvious, since the general contractor, who cannot know everything, has not the knowledge necessary to control the work of his sub-contractors; and if he undertakes work outside of his specialty he runs the risk of running over his costs, which he has probably not calculated correctly, and may suffer a considerable loss.

Need of Specialists in Concrete Work

The constructor of reinforced concrete should refuse all general contracts and owners and architects should avoid giving work to general contractors. The practice simplifies their work but exposes them to serious consequences. In these modern times, specialization is a recognized institution; the constructor of reinforced concrete cannot undertake general contracts and, still less, build on his own account.

Many firms have a number of representatives who solicit their business. Their immediate sphere of activity is too small and work is sought at a distance, on all sides. The representative who is a favorite with the management announces that his firm can have a piece of work if it will consent to a reduction in price. So the firm reduces its price. But, a few days later, another firm makes still more advantageous offers for the same work. The representative counsels his firm to meet any competing bid, if it does not wish to be eliminated forever. The representative always gains his point; he cares little whether or not his firm suffers a loss; in any event, he has made his commission. A loss does not prevent his firm from being influenced in the same manner again, until, gaining wisdom

through repeated losses, it rejects the representative's advice, and the latter, in a rage, goes over to the camp of the enemy.

Business at Cost Poor Policy

On other occasions, more frequent than is generally supposed, the contractor who has already been awarded some contracts at a good price, being assured of a good year, says to himself that he can accept some business at cost, thinking by this means to reduce his general expenses. This reasoning is simply self-deception, since the new work requires an increased force, if his ordinary staff is already occupied, as well as new material, with its wear and tear to figure on, and increased expenses of financing.

Bad figuring, outside of all technical valuations, which cannot be treated here, since we desire to limit ourselves to commercial considerations, is related to superintendence, which plays so large a part in the success of an enterprise. Unfortunately, honesty is not too common a virtue, and the activities of a few foremen may spell the ruin of an enterprise. We shall give one example only.

Handling the Purchasing Department

In one large undertaking, the foremen ordered the material direct from the supply houses and reported their purchases to the office, which made accounting to the management, expenditures being evidenced by vouchers checked by the office and therefore considered correct by the cashier. No irregularity could be suspected without collusion of three parties, the supply house, the chief bookkeeper and the contractor.

Nevertheless, a simple chance brought to light an abuse of confidence in a single enterprise amounting to more than 26,000 francs, which the three parties had divided.

Supervision here was lacking in two important points—a record of the arrival and the delivery of materials; a check record in the office of the value of materials ordered and used, and above all, the observation of the management, comparing these quantities with those normally observed.

Leaks in Figuring Form Costs

The weakest point in reinforced concrete contracting lies in figuring form work costs and carrying them inaccurately on successive balance sheets. Some firms credit the forms account with the quantity used in each job; others deduct at the end of the year from the debit of the forms account a certain percentage representing the estimated value of the wood used; still others take at the end of the year an inventory of stock on hand. No fault can be found with the latter procedure unless the reality does not correspond with the estimate—and here is the milk in the cocoanut. The percentage taken usually runs between 30 and 60 per cent.

The firm that bases its figures on 30 per cent. is deceiving itself and its stockholders, while in reality it has suffered a considerable loss. Some firms escape this self-deception by taking an inventory of their stock of lumber every year, but this procedure is accurate only when the latter is estimated at its real value and not at its invoice value. To be perfectly secure it is proper to combine the two plans. The inventory is taken and the stock put in at its true value; at the same time figures are taken as above on the 60 per cent. basis and the less favorable of the two results is put in the balance sheet.

On current work, it may be estimated with a view

to the figures at the end of the year, that wood can be used once and a half a year and that each use consumes one-half of the value of the wood, which amounts to figuring that the same wood can be used two and one-half times in all.

Essentials in Accounting

The accounting of work under construction is another rock on which the balance sheet may split. Suppose that it is a question of a firm with a capital of 1,000,000 francs, which desires to show a net revenue of 10 per cent., or 100,000 francs. By taking work under construction into account, which may amount to several million francs, increasing or diminishing by 100,000 francs, this is an easy matter, even for conscientious managers; for deduction is a very elastic thing.

The law requires that the value of merchandise (and this must certainly include work under construction) shall be carried on the balance sheet at the cost price of the supply house and not that of the firm. The law, however, makes a wide difference between these two terms, meaning by the former an expenditure of any kind necessitated by construction, including raw material, salaries, inspection on the job, cost of operating machinery—in short, all the expenses *de visu*, whatever are the special conditions of the work being done. Therefore, one ought not to figure in this the general expenses of management, the depreciation of buildings and machinery, incidental expenses of the business and so on. If these expenses are added, the law indicates the figure obtained by the cost price of the firm, which, increased by the net profit, constitutes the selling price. It is unfortunate that not everyone is in accord in setting these figures in practice, and for this reason the item of work under construction ought to be estimated with great care; no one can have a proper idea of the exactness of the accounting without knowing the bases on which it is made. Examination by an auditor is not very valuable, since he has not the necessary technical knowledge and can rely only on the explanations given by the technical advisers of the management. I once ran across a case in which the accounting of the work under construction showed the profit hoped for and who knows how many similar cases there are?

I believe that cost price should include the following items:

Raw materials (sand, gravel, steel, cement, forms, etc.), to which should be added the costs of transportation and unloading:

All salaries and superintendence in the work;

Traveling expenses of the management and its representatives;

Material used on the job (nails, coal, grease, etc.);

Lumber for forms, estimated at 40 per cent. of its value, on the hypothesis that in the inventory of the lumber, 60 per cent. of its cost price has been deducted; if less is deducted the item of lumber used in work under construction shall be lessened to correspond.

No other expenses, including depreciation of machinery, shall be added.

There is still another source of error to be guarded against. Some firms carry on the balance sheet the expenses contracted at the supply house only; others determine what work is still to be done, and its cost price and figure the difference between the known expenses of this work and the total of the business. Both of these plans lead to grave mistakes. In the first case, it is not taken into consideration that the

price on which the bid has been based may have been figured incorrectly, so that the completed work may represent a loss. In the second case, if one is content to deduct the work remaining to be executed, the balance sheet contains the total profit, even when the smallest profit must be overlooked.

To avoid self-deception, both methods will be used.

Here is an example, taken from actual work, which shows the differences in result, according to the method used:

The bid was 500,000 francs and in this sum were included 10 per cent. for general expenses and 6 per cent. profit. The net cost should, therefore, have been 500,000 francs less 80,000 francs, or 420,000 francs. In reality it amounted to 459,000 francs, or 7 per cent. more than was calculated.

The expenses shown by the balance sheet were 300,000 francs; in reality they should have been lessened by 7 per cent. and 279,000 francs written.

The different procedures of accounting would have given:—

(1) 30,000 francs, or 21,000 francs too much.

(2) Figuring a fraction of the general expense of the whole contract, 300,000 francs + 35,000 francs, or 56,000 francs too much.

(3) Taking the percentage of the profit, 300,000 francs + 35,000 francs + 21,000 francs; or 77,000 francs too much.

(4) Taking the price of the bid, less the work still to be done (a very popular method) 500,000 francs — 141,000 francs = 359,000 francs, or 80,000 francs too much.

(5) It would have been accurate to deduct from (4) the estimated general expenses and the profit, or 359,000 francs — 80,000 francs = 279,000 francs, and this figure would have been adopted because it was lower than (1) and still it would not have been very close to the actual facts.

Water-Bound Macadam Roads*

By Joseph W. Hunter

THE macadam road of today takes its name from that illustrious pioneer road builder, a Scotchman, John Loudon Macadam, through whose influence the condition of roads in Scotland and England was greatly improved more than a hundred years ago. Today the "water-bound" macadam road is considered by many as a relic of the dark ages and the road-builder who advocates the laying down of such a road is apt to be considered a man with antiquated ideas, a fossil, a man far behind the times and speed of the twentieth century. The writer does not agree with this view. Every system of road or street improvement has its place in the great work of making better the roads and highways of today. A system of highway improvement as used in the great centres of population, where the traffic is dense and almost indeterminable, if applied to the rural districts of the State would be considered a piece of folly not to be tolerated.

The brick-paved road and the concrete road have their uses and are the types of road to be laid down in certain localities and on certain kinds of soil. The bituminous macadam and asphaltic macadam roads are in much favor at the present time as having an ideal surface to travel over, being less dusty and more nearly waterproofed than other surfaces and said to be less costly to maintain. This, however, is problematic and subject to experiment and proof. For highways that are main lines and subject to extensive motor and other vehicle travel, the bituminous macadam in connection with the brick pavement immediately adjacent to the centres of population is undoubtedly the better method of construction.

Along many of the most traveled roads, there is a neutral axis or section of the road that is but little used which can well be improved as a "water-bound" or telford macadam road. A macadam construction is all that is necessary on many miles of lateral roads or roads in a purely rural community, or where motor vehicle traffic is light, the cost of construction being less than that of other kinds of construction and the cost of maintenance, if properly done and done at the right time, will not be more than one-half to one cent

per square yard per year; if this amount is expended each year the public will have a good surface to travel over, not only some time, but all the time. "Water-bound" macadam has two faults as an ideal pavement for light traffic, or on the ordinary country road. One of these is the tendency to break up under motor vehicle traffic and the other is its liability to absorb water. These can readily be overcome by the application of a bituminous wearing surface. In this connection and for the purpose of supplying a base for a bituminous or asphaltic cement top or surface, I believe that "water-bound" macadam makes as good, if not better, foundation than concrete.

It has the inherent stability and lacks the creep or shear in expansion and contraction of its aggregate. It is more resilient, causing less wearing on the surface, consequently permitting of a thinner working surface than a more rigid or unyielding concrete base. "Water-bound" macadam that is well shaded will but seldom ravel or become dusty, as the moisture is held in place and not evaporated. Usually a "water-bound" macadam laid on or over a heavy damp soil does not become dusty. It may ravel in very dry weather, but soon recovers after a rainy or damp season. This is notably so when the surfacing is composed of limestone.

If water is convenient and properly applied to the surface of a "water-bound" macadam road, no such road should ravel or become dusty. The water should be applied at night so that it may have an opportunity of penetrating into the surface and not evaporated by the sun or converted into steam upon coming in contact with the superheated surface. The watering of a road surface, if the material is adjacent to or of easy access, is a cheap method of maintenance, costing about two to three cents per square yard, where the price paid for water is from 75 to 85 dollars per million gallons. If the water is obtained from a stream along the roadside the cost will be less.

The external forces to be overcome in traveling over a highway are usually gravity, friction, collision and air. Gravity and friction are in a measure over for if the highways should be perfectly straight and at the same time level, two conditions that are rarely obtained in the same road. The overcoming of the

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external force of collision, as well as that of friction, depends upon the character of the surface. A hard smooth surface offers the least opportunity for collision; friction and gravity are more easily overcome and consequently less tractive force is required in propelling a given load over a given distance. With a hard smooth surface and a more rapidly moving vehicle, the air pressure, or resistance, becomes greater and in a measure counteracts the gains made for surface or wheel friction or traction.

What material will give the best surface for rapid, safe and economical travel and at the same time offer the least resistance to gravity, friction and collision and also accommodate both horse and motor vehicle traffic? Bricks make a hard and comparatively smooth surface, but the external collision force is hard to overcome and presents a considerable obstruction or resistance to a rapidly moving vehicle; for heavy or slow traffic this resistance is not apparent. A concrete road is subject to the same criticism, except that the collision force is not so great. Both a brick and concrete surface is objectionable for horse traffic. The ordinary "water-bound" macadam surface or telford macadam surface is a better one for animal traffic, and if properly maintained is equally as good for motor vehicle traffic. The collision force will not be so great as on a brick pavement, but tractive force will be slightly increased.

The one surface that more nearly meets all the conditions as giving the least possible resistance to collision, friction and gravity in saving rapid, safe and economical travel and at the same time giving a surface practically dustless and waterproof, is the asphaltic macadam surface. The one drawback to such a hard smooth surface, which is not found in the "water-bound" macadam surface, is its tendency to become slippery in wet weather, thereby becoming dangerous to horse traffic.

A better and more uniform surface of "water-bound" macadam will be obtained when more care is given to the preparation of the foundation upon which is to be placed the crushed or telford stone; when more care is taken in the selection of the mineral aggregate, cubical instead of triangular, oblong, or semi-round stone used, stones that under traffic will bond together, and only of such hardness as will be kept bonded by the traffic, much of the ravelling of "water-bound" macadam is due to the action of the elements and lack of sufficient traffic over the surface—when more care is taken in placing the top course of stone, spreading it in from the side of and not dumping it in the middle of the road and then spreading or levelling the material; and with more care in applying or feeding screenings and water and in rolling. Such a surface will last longer without repairs and be an ideal surface for ordinary travel, both horse and motor vehicle, and one that will make as good a foundation for an asphaltic macadam surface, as can be laid, when the increase of traffic warrants such construction.

Many of the old turnpikes that now form parts of the system of State highway routes will be maintained as "water-bound" macadam roads until such time as the Department is warranted by reason of increased traffic in laying a surface of other material. These turnpike roads were originally built and maintained for years with stone, broken by hand on the side of the road and then spread on the foundation prepared to receive them. No rollers were used, but the traffic that passed over the stone bound them together. It was by this method that Mr. Macadam reconstructed

the old pike roads of England. In the counties where limestone is plentiful most of the 700 miles of toll roads in the State are to be found, many of such roads having an ideal surface, save for a dusty tendency at times, such surface being maintained solely by the traffic, no rollers being used.

I believe that with so many opportunities to make use of "water-bound" macadam economically and to advantage, the time has not arrived—and will not arrive for many years to come—when that method of reconstructing public highways can be dispensed with. It will be in use when some of the methods which are being experimented with today are cast aside.

At the corner of Tenth Avenue and Thirty-sixth Street, New York City, the architects, Goldwin, Starrett and Van Vleck, have provided plans for a twelve-storey skyscraper, in which the entire front of the building and its interior sides are to be of glass. In fact, 78 per cent. of the walls will be of this material. There will be no openings in the glass facade except those in the front of the building for emergency purposes, but which will not be visible from the street. It is estimated that the structure will cost approximately 600,000 dollars, of which amount 78,000 dollars will cover the cost of the glass. On the interior the glass will be a specially polished plate, and for the exterior surface will be specially treated plate that will not transmit heat waves into the interior.

Artificial stone is made, according to a patent by W. Laufer, 4 Gertruda, Cracow, Austria, as follows:—Granite or greywacke, basalt, porphyry, or the like in coarse and in fine granulations, are mixed with aluminium phosphate and sodium carbonate in about the following proportions: 40 parts of coarse porphyry, 50 parts of fine porphyry, such as porphyry tuff, 6 parts of aluminium phosphate, and 4 parts of sodium carbonate. The mixture is moistened, pressed into blocks, and heated to about 1,000 deg. to 1,200 deg. C. Silica and lime may be added in quantities of from 5 to 10 per cent., to regulate the clinkering. To increase the cementing power of the mass, colloidal alumina may be added in the proportion of from 2 to 8 per cent. aluminium hydroxide in the whole mass.

A wooden derrick-boom broke in half while raising a load of six tons of steel columns from the street to the sixth floor of a building now under construction at Broadway and 37th Street, New York city, on November 29. The derrick was installed on the sixth floor, and the boom had lifted the load 4 ft. above the ground when the topping lift snapped, dropping the load to the street, and the boom upon the steelwork of the sixth floor. The boom (which was 70 ft. long by 14 in. in diameter) snapped at the point where it struck, the overhang falling to the street. Ravitch Bros., of New York City, who are handling the structural steel contract, state that this same derrick hoisted loads of from 20 to 30 tons each about ten days ago on the same job.

The province of Quebec constructed about 225 miles of macadamized roads and about 60 miles of graveled roads last year. About 40 miles of roads between Quebec and Montreal are now underway, and the King Edward Highway is nearing completion. In all about 900 miles of roads have been either constructed or extensively repaired during the year.

Advantages of Reinforced Concrete in Factory Buildings

By Harry C. Spillman.

THE great changes which have occurred in manufacturing during the last decade have brought about a new epoch for industrial buildings.

Improvements in modern machinery, methods of operation, Scientific Management, high-speed steel and short cuts in production have demanded buildings suitable for the line of manufacturing they are intended to house. The highest efficiency can only be obtained by having buildings planned to secure these ends. The small factories of a few years ago are mammoth institutions to-day. The owners of these plants have discovered that their plants have become many times larger than their fondest hopes in the early days of their organization, and many of these owners of manufacturing plants are face to face with the vexing problem of more room.

If these owners will study their present conditions they will find their plants, from the manufacturing standpoint, in a more or less chaotic condition and their manufacturing costs climbing up. Increased room demanded in one department has blocked the expansion of another; machines have been crowded into small spaces without sufficient room for the operators and material; the trucking aisles are too narrow and the material, instead of having a continuous routing from the rough stock room through the manufacturing and assembly departments, takes a zig-zag course, retracing its steps and meeting itself going and coming in all parts of the factory. This requires a small army of truckers, inspectors, and stock chasers to keep this material in process of manufacture, and the department heads are becoming worried over delays and cancelled orders.

Industrial Engineering

The only solution to this problem is a factory built especially for the work intended. This has created a new engineering field, as it calls for an engineer who can plan buildings suitable to meet the exact conditions and the routing of material without retracing its steps, so that it travels in straight lines. This labor-saving, in cutting down to a minimum the trucking of material, will often save the manufacturer a sufficient amount in his manufacturing costs to warrant the expenditure for a new plant. The engineer must plan for future expansion, so that each department can grow almost indefinitely without running into or crowding out another department. All factories demanding larger quarters are growing concerns and their new plant should be capable of taking care of all future requirements. If this point is lost sight of the owner will find within a few years that he will have to rebuild again. These are the main features of making preliminary plans for factory buildings, and it is always best to lay out the factory and purchase the property to take care of the lay-out instead of trying to make the building fit the property. If this is not done the buildings will have to be altered and rearranged, and the plants will not be entirely satisfactory when completed. It took years for the idea to be fully realized, that intelligent planning means economy. An expert engineer can save many times his salary during the construction

of the building, and his fee will pay big dividends in after years.

In choosing a site, properties located away from the heart of the city near the suburbs, but having good street car connections and shipping facilities, make the best locations. Property in such a locality is cheaper, and there is sufficient room for future expansion; moreover, living conditions for the men are far better. It attracts the best class of workmen and the men are more contented than in the crowded shops in the city.

After the preceding requirements are carefully considered, real designing of the factory commences, and the type of building is one of the first problems. Reinforced concrete buildings are popular, and certain facts concerning this type will be of interest. They are lower in ultimate cost than other kinds of buildings; in fact, their first cost comes very close to that of slow-burning mill construction and is lower than that of fireproof steel construction. Concrete has a low depreciation charge. In reality, as concrete becomes harder with age, a reinforced concrete building originally designed for four storeys will allow a fifth floor to be added after the building is three or four years old. Authorities on depreciation give a maximum depreciation of 1.5 per cent. per year and some as low as 0.75 per cent.

Fireproof and Sanitary

A reinforced concrete building is fireproof. This is of high value to a manufacturer in reducing his insurance and preventing a bad fire in his factory, which generally gives a manufacturer two or three years' setback, and often proves disastrous to his business career. Fires of intense heat penetrate concrete less than an inch, which does not allow the reinforcing steel to become exposed. Replastering the thin layer of concrete which the heat has disintegrated, the replacement of the broken glass, and a new coat of paint will make the building as good as ever.

The sanitary qualities of reinforced concrete buildings bring forth another advantage, as a building of this construction is free from dry rot and dampness and it can be thoroughly washed out with a hose without damaging the building. Sanitation makes healthful working conditions which have a direct bearing upon the efficiency of the workmen.

Other Important Characteristics

A characteristic which makes reinforced concrete buildings stand out from all other classes of buildings is the load-carrying capacity and the ability to absorb vibrations. A floor designed for 150 pounds live load per square foot will generally carry a load of two or three times this amount without showing any deflection, and in case a heavy load is concentrated on a small area, it will distribute this load over a large floor area.

Reinforced concrete buildings are built of the skeleton type, which allows a maximum of glass area; generally, 75 per cent. of the wall area is glass. The flood of daylight throughout the plant increases the workmen's efficiency, and also cuts down the lighting bills. The large window area allows more ventilation and

enables the owner to increase the width of the buildings and still have sufficient light at the centre.

But little difficulty is experienced in installing machinery in concrete buildings. Embedding small strips of wood in the concrete and nailing to these strips a sub-floor of $1\frac{1}{8}$ -in. pine and over this a maple floor about $1\frac{1}{8}$ -in. thick, makes an excellent floor for manufacturing purposes. It gives $2\frac{1}{4}$ -in. thickness of wood, so that the machinery can be easily fastened by means of lag screws. This floor is easy on the men's feet and shows excellent wearing qualities. By means of embedding in the concrete ceilings cast-iron spools threaded for a $\frac{3}{4}$ -in. bolt, or placing long metal inserts in the concrete ceiling, shafting, piping and electrical conduits can be easily suspended. For attractive appearance reinforced concrete buildings can compare favorably with other types of constructions. By the clever use of ordinary pressed brick and cement plaster a well-designed reinforced concrete building will equal in beauty the most expensive buildings made up of brick and cut stone. Beauty in manufacturing plants is of recent origin. Its value has many factors which make it impossible to measure. Workmen take pride in the place in which they work. The advertising value is of importance, and neatness and beauty raise the property value. Such a building is a source of pride to its owners and expresses the ideals of the company to the public.

The remarkable development of reinforced concrete has brought upon the market many different designs which have certain advantages for the work intended. The girder type works out very successfully for long spaces, if it is desired to have the building entirely free from interior columns, with large, unbroken floor spaces. The outside building columns are placed on about eight-foot centres and a heavy concrete beam is poured from column to column across the building.

The floor above is usually a concrete slab (about 6 in. deep) resting directly upon these girders. The only objection to this type of construction is the great depth of the concrete girders, which sometimes is as much as five feet.

If the building has interior columns the builder has the choice of a floor supported on beams, girders and beams, or a plain flat slab. Using the former method, there is some difficulty in running pipes and electrical conduits, as the beams offer an obstruction.

Flat Slab Construction

The flat slab has one advantage in that the ceiling is entirely clear of obstructions, and shafting, piping and electric wiring can be easily installed. There are several methods of flat-slab construction. The best for manufacturing plants is a solid concrete slab of 8 or 10 in. thickness. This adds additional weight, which has to be taken care of in designing the building, but this extra weight absorbs all vibrations from moving machinery which can be placed on any floor. Another flat-slab scheme is to use hollow tile and insert a narrow concrete beam between the various rows. This method calls for the tile to be plastered underneath in order to obtain a finished job and gives a lighter slab. It makes an excellent floor for offices and stock rooms, but lacks the necessary weight to absorb machinery vibration. It is customary to design reinforced concrete buildings with the interior columns spaced between sixteen and twenty-five feet, according to the use of the building.

The reinforced concrete building successfully answers all problems in building construction for manufacturing purposes; when completed it will be as substantial as though cut out of solid rock, and will possess the combined qualities of granite-like concrete mixed with steel.

Imperfect Plans and Specifications^{*}

By J. M. Vollmer†

IN commenting upon the building problem there is one phase that seems to have entirely escaped notice or has been passed over for the reason that to rectify what is, without doubt, a serious drawback to the building industry, would entail a radical reform in a custom that has existed for a long time—a custom that has nothing to sustain its existence except a passive submission on the part of the contractor.

The phase to which I allude is that of bidding upon imperfectly drawn plans and specifications. The intent of plans is to show what is required and specifications should furnish a supplementary description of the work desired. This makes it imperative that all plans and specifications should be very plainly drawn and worded.

Statement of the Contractor's Position

By using the old expression that "the tailor cuts his garment according to the cloth" the building contractor's position is clearly stated with the possible exception of fine residence work, which is usually planned and built to suit the whim of the owner. With regard to building generally the paramount question is, "Will

the investment pay? Buildings for mercantile uses should be considered plants, whether intended for stores, offices or factory, and the cost of erection should not exceed the point where it will fail to produce a reasonable return on the money involved.

Here, in particular, is where the contractor resembles the tailor, as it is his duty to erect the structure according to the plans and specifications handed him by the owner and architect. This, in our opinion, is the greatest problem in contracting, for in almost every case the bids submitted exceed the original estimate made by the architect.

This condition is due entirely to the obsolete methods of preparing specifications and plans. Every branch of the building trade has advanced. Modern ideas and methods have supplanted old ideas and methods, new materials have been introduced and favored on account of their being more adaptable. Practically everything in building material is considered from the sanitary and fireproofing standpoint. In fact, progress has been made all along the line, save in the letting of work.

Old Methods of Bidding

The old method of out-guessing your competitor by bidding on vague plans and specifications is still in vogue. It would seem that in this day of enlighten-

^{*} The Building Age.

[†] Secretary Louisville, Ky., Builders' Exchange.

ment and mathematical precision that quantity and quality could be ascertained to the fraction of a penny and that the only difference to be found in bids upon a certain contract would be the percentage of profit expected by the competing contractors.

The opposite is the case, however, and the cause is directly traceable to the obscure manner in which the specifications and general conditions are prepared. The elimination of the doubt about material to be used by specifying in plain words the character and quality, the exact method of their introduction into the building and furnishing all details instead of determining upon these important points after the contract is awarded would in a large measure prevent the custom of revision of the original plans in order to get the cost somewhere in the neighborhood of the owner's estimate. In other words, get the desired garment out of the cloth submitted.

Undoubtedly a large percentage of work is postponed indefinitely, and the reason, we believe, is that the bids offered were greater than the amount of money destined to be placed in the structure. Here is the

problem and the result can easily be found by simply eliminating blanket clauses and obscure passages in the general conditions and specifications. We believe that by doing this we will not only find the cause of all building difficulties, but will insure a decrease in the cost of construction from 10 to 15 per cent.

The discrepancies between the architect's estimate and the bids submitted would disappear. Blanket clauses are used to cloak and protect. Their appearance in a contract is an admission of fault in the general conditions. Errors will crop out, as it is human to err, and where inaccuracies occur the parties directly responsible for them should bear the cost. In the case where the contractor is to blame, his bond will suffice to reimburse the owner. If the mistake is with the plans and specifications the loss should be at the expense of the owner or his agent.

By removing all question as to what is desired, the owner will be served better and the gambling aspect which has so long attached itself to contracting will be removed, and building for investment will become more profitable.

What Advertising Means to the Contractor

By Charles L. Pitts, Toronto.

MOST contractors recognize the value of advertising and yet many consider it too costly to adopt. Advertising may be costly and inefficient, but it is possible to get excellent results with little outlay. For the contractor advertising may be considered under the following classes: work advertising, general, letter and office advertising. It is a matter of the cost of the work and the ingenuity of the advertiser. For the average contractor the services of an advertising expert are unnecessary, as he himself can devise a form of advertising as will attract the public. Contract advertising must be dignified, but at the same time not too conservative. Individuality is the very life of advertising.

Work Advertising

Work advertising is any form of advertising around the job. Signs, valuable as they are, do not complete this method. In sign advertising some particular colors should be adopted so that in all work even at a distance the sign will be recognized. A sign is often spoiled by too much printing because it renders it indistinct at a distance; it has also a tendency to detract from the dignity of the firm. The idea is to call attention to the work which should reflect the character of the company. The time-honored wording, "carpenter work in this building neatly done by Jeff. Smith & Sons, Phones —. Reddin Building, Toronto, Ont," looks better if simply worded:

Jeff. Smith & Sons,
Carpenter Contractors
Reddin Building, Toronto

It is understood that the work is in that building and that the company has a telephone. Phone numbers are sometimes changed and then the signs have to be reprinted.

There is also the tool box as a valuable aid in work advertising, particularly in private work. The writer knows of an instance where five contracts were secured by a concrete contractor as a direct result of having a neatly painted tool box on a car-track street on which he happened to be working. The tool box should be painted in the recognized colors of the firm and it need not have extravagant wording such, for example, as "exceptional and high grade work." It is understood that the firm considers its work "high grade," but any uncommon device in the construction of a tool box is an advertisement. Adopt one that will attract the eye from a distance, such as:

Bryan & Midlow,
Concrete Contractors,
Wedlaw Building, Toronto
Public and Private Work

Signs, tool boxes, wagon sheds; the more widely the firm's name appears the better. The trick of some small contractors in having a tool box numbered, "gang No. 6" when there are only two gangs actually in their employ, is obviously a false advertisement. Work advertising need not be costly but it must be dignified.

General company advertising as applied to the small contractor takes in newspaper advertising, letters, and signs on places other than actual places of work. In newspaper advertising it is well for the contractor to remember that bargains are not offered, as

in selling groceries; what is wanted is simply a statement of the name, place and nature of business, and phone number. For example:

Jones & Weatherspoon

Carpenter Contractors

Large and Small Jobs

10-11 Englehart Bldg.

Phones — —

A man doesn't look for a contractor until he needs one—not like the bargain hunter when there may be something cheap—therefore sensational newspaper advertising is detrimental because it looks shoddy to men whose business really counts.

Letters are a very valuable form of advertising in private contract work. Even when it is possible to send a letter with a tender there is an opportunity for a good straightforward talk. This is the most important consideration in letter advertising:—talk to the point and in a way to try and convince the reader that good faith is intended. A letter written in a very self-praising strain may be successful in selling "wildcat" mining stock to widows and country school teachers, but it doesn't convince the man with a knowledge of the contracting business. A letter to an architect, for instance, need not go into details about the quantity of material to be used. That is the architect's part of the business. But if it succeeds in convincing that man that the writer of the letter is honest it often brings the business. Every experienced man knows that it is easier to be dishonest in concrete work than in any other form of contracting. Therefore a letter that will convince the architect or builder that the concrete contractor will do honest work will not only get the business but will hold it providing that the work really is honest. A letter should be simple and should not look too much like a circular.

McGILL & ROSS,
Carpenter Contractors,

6-7 Milton Building, Toronto, Can.

John Dough, Esq., Toronto.

Dear Sir:

We are prepared to tender for carpenter work under your supervision on any buildings for which you are the architect and we are willing to leave a stated percentage as a "drawback" to guarantee our work. We are ready to accept your opinion as final in respect to all material.

A member of this firm will call on you at your convenience.

Yours truly,

McGill & Ross.

This is merely a rough form as an illustration without considering any of the general conditions which may be met with in connection with any particular business. Advertising letter-writing is an art in itself. General signs are such signs as may be placed over any storehouse, yard or other permanent place. If there are two or more yards it is well to have large signs and to number the yards. A yard being permanent is unlike a tool box as it is not seen in different parts of the town. Nothing looks more like a false advertisement than to see a "Gang No. 5" box as the only one in evidence when there are only two gangs working. To the contractor who cannot

live up to it, overdoing advertising is nearly as bad as none at all.

A prominent Toronto business man gave this advice when his son commenced business as a contractor—"Don't economize in your office furniture." False economy shows more in an office than in any other place. It is not expected that a contractor's office is to be furnished like the office of a bank president, but on the other hand where office furniture consists of a cheap table and a filing system that looks like a school-boy's desk with an easy teacher in charge is a poor advertisement. People naturally think when they visit such an office that the contractor isn't a very business-like person.

Advertising for the contractor is not a new idea. It is recognized by all construction firms, and to the small contractor, dealing more directly with the public than the large corporation contractor, advertising is one of the most important considerations in his business.

Day Labor and Contract

A large city in the middle west is planning to do a considerable part of its public work by day labor. It proposes to establish a bureau of construction and to secure equipment and a labor organization. Following the plan of some Canadian cities it will then submit bids for municipal undertakings in competition with contractors. Bidding under its own specifications, on its own plans, and doing its own inspection, the bureau quite likely will be able to underbid its competitors on some piece of work. Whether or not the cost of the completed improvement will show a saving over the prices bid by the contractors remains to be seen. Judging from the experience of other cities it will not. In many cases where an apparent saving has been made by day labor, this good showing has been due more to the method of bookkeeping than to the economical handling of the undertaking. By the judicious spreading or omission entirely of overhead costs, interest and depreciation on plant, by the leaving out or changing parts of the work, or by the improper spreading of direct charges, it is possible to make considerable difference between the book cost and the real cost of a certain piece of work.—Engineering and Contracting.

Dogs in field service were utilized in the construction of the National Transcontinental Railway. Their use was described recently by Mr. R. F. Uniacke, bridge engineer of the National Transcontinental Railway, at the Canadian Railway Club. Not only were dogs used to transport the mails over the snow-covered trails, but they were also employed in the summer time to operate a light pile driver used with a pump for sinking 4-in. pipes to secure wash-boring tests of the soil in the river bottom. The dogs were hitched to capstan bars of a windlass on a raft on which the pile driver and pumps were installed.

The effect of frost on the lead service pipes of the city of Liverpool, Eng., is mentioned in the 1912 annual report of Mr. Joseph Parry, chief engineer of waterworks. Between January 28 and February 5 there were reported 10,948 burst lead pipes and 61 burst iron pipes. The consumption of water in and around the city rose from 205,000,000 gal. for the week before the frost to 272,000,000 gal.—an increase of 32 per cent.

Cost of Skyscrapers

A careful record on the structural work of numerous first-class office buildings has been kept by F. W. Fitzpatrick, a consulting architect at Washington, D.C., who has found that a fair average of them is the following cubical cost. The figures are in cents per cubic foot of building:

The foundation cost	1 3/4
Steel framing	2 1/2
Granite and all masonry	11 1/6
Cornice, roofs and skylights	2/3
Fireproof floors	2/3
Partitions (tile)	2/5
All plastering and stucco	1 1/4
Elevator fronts and all ornamental metal work	2
Marble work	3 1/6
Hardware	2/15
Joiner work	1 1/6
Glass	5/12
Painting and varnish	7/30
Electric wiring	2/3
Heating	1 1/8
Plumbing	1/2
Elevators	1
Stairs, scenic structural framing "making ends meet," lamp fixtures, etc. What might be called a fair amount for "contingencies" in such a building, including lesser items not mentioned here but grouped together	4 23/120
Architect's fee	2 3/5
Total	34 5/12

Civil Engineering

By Geo. Fitch in The Engineering Record

A civil engineer is a quiet man with a thick coat of sunburn, who spends his time revising climates, editing the landscape and training up rivers into lives of usefulness. In order to do this the civil engineer does not tear the earth wide open with 100-ton spades or perform other feats of strength. He is usually of ordinary size and if he only used his own hands he could not push around a small creek, let alone a river. The civil engineer does not rely on muscle. When he desires to move a mountain or wipe out a few hundred square miles of desert with a dam he takes his logarithm book and retires to a quiet spot where he fills an acre of brown paper full of figures. At the end of six months he emerges with a tired air and a carload of blueprints and motions to the steam-shovels to come on up and get busy.

The civil engineer is not generally known. This is because he cannot often be found on the street corners or in the clubs or in the act of decorating grand opera with a vast white shirt front. He usually lives in the wilderness in hip boots and a last week's shave. After the ordinary man has lived in a wilderness for a few years his mother wouldn't know him. But after an engineer has lived in a wilderness the same length of time its mother wouldn't know it. The engineer is continually editing and revising nature, rearranging mountains and making rivers back up and go the other way. He is as restless and unsatisfied with the way things look as the woman who always rearranges the parlor furniture while her husband is away so that he may fall over it when he comes home in the dark and receive a pleasant surprise.

The civil engineer has hung railroads on mountain

sides, run tunnels under city streets, made oceans shake hands, harnessed up Niagara Falls, made parks out of the Western deserts and has put a reverse gear in the Chicago river. Some day he will begin experimenting with the earth's orbit and we may yet have Christmas at the Fourth of July and a weekly comet service to Mars—who knows. Logarithms and a square law working harmoniously can do almost anything.

Contract Conditions at Vancouver

THE following clauses in the general conditions of contracts carried out for the city of Vancouver by private contractors have been adopted by the Board of Works:

The contractor shall not employ upon the work, or in connection therewith, any workman or employee for more than eight hours in any one day of twenty-four hours during the continuance of this contract, nor shall he employ any such workman for more than forty-four hours during any one week, the intention of this clause being that the contractor shall allow to each of such men one-half holiday during each week during the continuance of this contract. The working day shall commence at 8 o'clock a.m., and end at 5 o'clock p.m., excepting on Saturday, when it shall end at 12 o'clock noon. The noon hour may be curtailed by special agreement between the contractor and the majority of the employees, but not in such a manner as to permit more than eight hours in any one day of twenty-four hours; but if two or more shifts of men are working in one day, the same men shall not be permitted to work on more than one shift, and such shift shall not be considered overtime. Overtime shall not be allowed under any pretence whatever, except when human life is in jeopardy or property in danger of destruction. In such cases, overtime will be allowed until the work is secure from danger, and no longer, except by a written order signed by the City Engineer and the chairman of the board of works, and all such overtime shall be rated at time and a half, and in the event of the contractor employing or permitting any workmen or employees to work on this contract for more than eight hours in any one day of twenty-four hours, or to work more than forty-four hours in any one week contrary to the provisions of this contract, he shall forfeit and pay to the corporation the sum of \$5.00 per hour for each and every man whom he shall permit to work over the said eight hours or the said forty-four hours, which sum or sums shall be liquidated and ascertained damages, and shall not be considered a penalty, and may be recovered by action or deducted by the corporation from any sum or sums due or to become due to the contractor under this contract, or otherwise. And it is expressly hereby agreed to by the contractor as to the time of employment of workmen on the said works, and in the event of the contractor making any breach of the said conditions the corporation may, at any time after such breach, by notice terminate this contract, and the contractor shall in such case have no claim against the corporation for compensation or damages by reason of such termination.

The contractor will pay or cause to be paid to any workmen, artisans, mechanics and labourers employed under or in connection with this contract a rate of wages not less than that recognized from time to time by the fair wage officer of the Dominion Government of Canada for the City of Vancouver and surrounding districts as a fair rate of wages for competent workmen, artisans, mechanics, or labourers, when employed in similar work to that hereby contracted to be performed and carried out; provided, however, that notwithstanding anything herein before contained, the contractor shall pay or cause to be paid to all workmen employed by him, or by any sub-contractor under him in the execution of

this contract, a minimum wage of not less than thirty-seven and one-half cents per hour.

Conduit Work in a Fireproof Building

One of the most difficult problems encountered in designing the electrical work in buildings of certain classes is that of selecting the best locations for the ceiling outlets. And after the best that is possible along this line has been done it is often necessary, when the building is ready for occupancy, to add new outlets or to change the locations of some of those already installed. Moreover, such revisions of the wiring are quite liable to be troublesome to make in a



Fig. 1.—Portion of ceiling before plastering.

manner that is satisfactory. To take a specific example, consider the modern type of fireproof office building. The requirements of the tenants on any floor of such a building can hardly ever be fully anticipated while the wiring is being done; the work can only be laid out to meet their probable needs, and then when the arrangement of the offices is definitely known, important changes in the location of the ceiling outlets may be found to be desirable. Thus, at best, it becomes necessary to do more or less of objectionable cutting and patching in the ceiling. This process is expensive, and if the work is not done by skilled workmen the ceiling structure may even be materially weakened.

Having realized the foregoing difficulties, from experience in the construction field, a firm of electrical contractors in Chicago developed a new and very interesting system of concealed conduit construction, not long ago, the principal object of which is to provide new lighting outlets in a building without the necessity of resorting to any objectionable cutting of ceilings and floors and the consequent patching of the plaster. The first installation of this kind is now being completed in one of the large fireproof office buildings in Chicago.

Characteristic features of the construction under consideration consist in the fact that the conduits for the accommodation of the ceiling outlets are placed in the ceiling just above the plaster, and that, by means of a tool designed for the purpose, an outlet can be readily installed at any point in a run of conduit after the ceiling is finished, without the necessity of cutting a hole in the plaster larger than can be covered with a fixture canopy of the usual size. In fact, ceiling-outlet boxes will not be installed on any part of the job until the space on the various floors is rented and the tenants specify where the outlets are wanted.

The Webster Building, in which the system is being installed, is a 12-story-and-basement fireproof structure with tile floor arches. The National Fire Proofing Company made a special grooved tile block and soffit tile for this building,

the cost of which, it is claimed, was no greater than that of standard tile. In one or two instances when the tile setters ran out of the ordinary tile, the conduit was spaced to set in the seam between the arches, which demonstrated that this method is also practical.

The conduit was installed 13 inches center to center, almost throughout the ceilings (which is the maximum Universal layout), and was laid on the centering, or temporary planking, used by the fireproofing. The conduit hangers, which hook around the pipe and clamp to the flanges of the I-beam, were then set in place and locked up tight, securely holding the conduits in their exact positions. One end of each conduit run was closed with a gas cap, and the other end terminated in a small junction box. With only two exceptions on each floor, each junction box was the terminal for one end of each run in two adjoining offices. These boxes are approximately 6 by 8 inches, and are provided with a plaster cover with a 4-inch round opening in the center. This is all concealed, as are the conduits, by the plaster. A round flat cover is provided for the opening in the plaster cover, which is drilled for screws and countersunk so that when installed it protrudes only the thickness of the metal below the finished ceiling. When painted over this cover is not noticeable, though as a hand-hole it allows access to the wires and connections from all conduits terminating therein.

These boxes and conduits are flush with the bottom of the tile and are concealed only by the plaster. The home-runs from the junction boxes to the panel cabinet are one-inch conduits over the top of the tile, as is present practice. For greater flexibility all junction boxes are interconnected with one-inch conduits; an idea of this flexibility may be obtained from the fact that a switch in the northeast corner of the floor can be connected to a fixture in the southwest

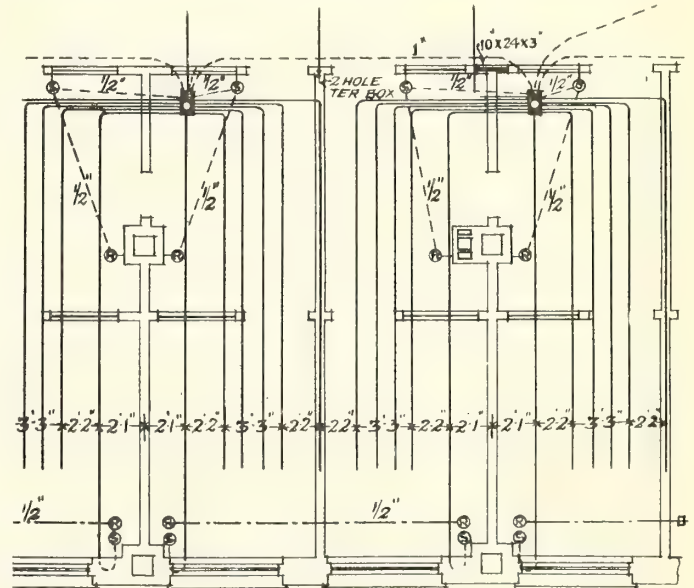


Fig. 2.—Plan of conduit construction.

corner without touching the plaster. The junction boxes replaced troughs which it was originally intended to use.

Switches and receptacles are being installed in columns and outside walls only, where they cannot be covered by future partitions.

A valuable feature made possible by this system as installed in this building is that all receptacle outlets to outside walls are connected with half-inch conduit. This allows the installing of a receptacle anywhere on this pipe at any time during the life of the building. All switch legs terminate in the junction boxes, and at this point may be connected to any or all conduits in the room.

Fig. 1 shows portions of the ceiling before the plastering

was done. The method of running the conduits from the junction boxes is brought out very clearly. Fig. 2 is a working drawing of the conduit construction in a portion of the ceiling. Dotted lines show how the junction boxes are interconnected, while the dotted line extending to the right from the junction box in the upper right-hand corner of the figure indicates the circuit from the wire shaft containing the risers from the service board in the basement.

Outlets will be provided by milling out the lower half of the conduit with a special milling machine and fastening a conduit-outlet box to the pipe with U-bolts, the box and bolts being of special design. It is claimed that the conduit can be milled out without disturbing the conductors and that no rough edge or burr will be left at the opening to injure the insulation.—Electrical Review.

The council of the Fort William Board of Trade passed a resolution recently requesting that the Railway Board defer action regarding the proposed station building of the Canadian Northern Railway until the Board of Trade have considered the revised plans.



Educational Facilities for the Clayworker*

Poor Men, Poor Products, says Professor Day

Guelph, Jan. 4, 1914.

Editor Contract Record:

I have read your editorial, "Educational Facilities for the Clayworker" very carefully. Knowing the product of the clay tile industry from one end of the province to the other, as I do, I am firmly convinced that there is urgent need for some educational facilities whereby the clay-workers of Ontario may receive technical training in the principles and practice of the industry. Many yards turn out tile of uniformly high quality, others of almost uniformly poor quality, while from some other yards the product is partly good and partly bad. I am glad to say that most yards turn out high-class tile, but from a few yards tile are supplied to the trade that cast a reflection, not only on the individual manufacturer concerned, but to a certain extent upon the industry in general. With a few trained men going out into the industry year by year from the university or technical school these weaknesses would be gradually eliminated and the industry in general would be highly benefited. What is true regarding tile must be true for clay products in general.

As to the best means of providing the facilities for this professional training, I think exception should not be made in the case of this particular industry. The training of professional men for this work should be provided on the same basis as the training of professional men for other lines of industry throughout the province. If it has been necessary for pioneers in other lines of engineering to have courses established by financial assistance from the industries concerned, then the clay products industry should not hesitate to deal with the matter in this way. But if these courses have been established by public assistance through the university and other schools, then a course in ceramics should be provided on the same basis. The need is great and the time is ripe.

I think the question of ways and means of securing the

desired end might well form a topic for discussion at the forthcoming convention of the Canadian Clay Products Manufacturers' Association.

Yours very truly,

Wm. H. Day.*

Mr. Joseph Keele Cites Growth of Industry

Toronto, Dec. 31, 1913.

Editor Contract Record:

At present there is not an educational institution of any kind in Canada prepared to give men either a full or partial training in ceramic engineering. Many of our universities already give almost two-thirds of the course necessary for the work, which includes geology, physics, applied chemistry, electricity, heat engineering, etc. The accommodation, equipment, and teaching staff required to give the complete course in ceramics could be added at a comparatively low cost. Most students after graduation would have to enter the employment of a manufacturer in some line of clay wares, so as to get practical experience. Certain of the large firms in the United States will give a year's varied employment to any student graduating in ceramics who applies for a position, with the promise of permanent employment if he excels in any of the departments of the industry.

The Ontario Clayworkers' Association made an effort five years ago to have a course in ceramic engineering established in the University of Toronto. The committee appointed by the Provincial Government, consisting of three of the members of the faculty of applied science and two members of the association, reported favorably on it, but the university authorities were not prepared to carry it out.

Considering the fact that the value of the output of clay products for the year 1912 was more than ten and one-half millions, and that Ontario was credited with about 45 per cent. of this, it is important that the clayworkers of the province should be granted their demands for technical education.

Yours truly,

Joseph Keele.†

President Falconer's Views

University of Toronto, Dec. 13, 1913.

Editor Contract Record:

I have read with a great deal of interest your article on "Educational Facilities for the Clayworker" which appeared in the issue for December 10. It seems to me we must before long develop greatly our educational facilities for those who are engaged in this industry, which is becoming one of the largest in the Dominion, and is of especial value to the people of this Province and the district around Toronto.

You are right, I believe, in making a distinction between the education that the University may afford and that which can be provided in the Technical Schools. We have made a very small beginning in the way of giving instruction in Ceramics for the man who is to become an engineer, and I have no doubt that before long this will be developed into a department of considerable importance. Indeed, as you mention in your article, nothing but financial difficulty has stood in the way of its development long before this. We are at present endeavouring to lay the foundation of such a department. This, however, would be intended, as in the case of the other university faculties, to train the man who is to take charge of large constructive works, the investigator into the quality of clays, and the research student, who might be of immense commercial value to the community. There is on the other hand the workman, the artificer, the foreman, whose skill the community requires. More and more we must think

*A discussion of an editorial article published under this caption on p. 87 Contract Record, Dec. 10, 1913.

†Professor of Physics, Ontario Agricultural College, Guelph, Ont.
‡Of the Geological Survey.

of his education. If we had a large department of Ceramics, we might be able to establish short courses for him in the interval until a trade school was established under the auspices of the Technical School, and such a trade school as this should before long have a place in our community. It is one of the steps that is necessary for the development of our workers. I hope, therefore, that we may look forward to having in the near future a full equipment for the education of the worker in clays, whether he be a director or engineer in charge, or the intelligent foreman and high-class artificer who will take pleasure in understanding his work and producing the best possible results.

Yours sincerely,

R. A. Falconer,

(President).

Mr. John M. Bowman's Objections

Mr. John M. Bowman, manager of the Don Valley Brick Works, asked for an expression of opinion as to the desirability of establishing a course of Ceramics in Toronto's new

technical school, said that he was not in favor of the project. Such a course as that suggested for the technical school could not be of much practical use for future clayworkers. Only by coming in contact with the specific clays with which a man was to be identified could he acquire any really useful knowledge of the successful handling of clays. Mr. Bowman instanced the case of a clayworker of more than twenty years' practical experience who had only within recent years acquired a thorough understanding of the clay bank he was operating. His own experience was that students emerging from such a course in Ceramics had been absolute failures when faced with actual manufacturing problems. A man might be thoroughly successful in the handling of one kind of clay but a total failure with another—an argument which led Mr. Bowman to believe that attempts at burning clays of various kinds in the technical school would lead to nothing but confusion. The only possible way by which a man could learn brickmaking thoroughly was to take up actual work in a yard where the manufacture of miscellaneous brick was carried on. Then he would learn to familiarize himself with the properties of the various clays in use.

The Successful Tenderers for Vancouver's Thirty-Million-Dollar Contract

By our London Correspondent

IT was announced recently in these columns that the firm of Messrs. J. G. White & Company, Limited, electrical, mechanical and civil engineers and engineering contractors, of London and New York, had secured a contract to the tune of some \$30,000,000 for a scheme of harbor extension in Vancouver—where certain foreshore rights have been granted to the Vancouver Harbour & Dock Extension Company—and we have thought that some particulars of the firm and of the work they have executed in all parts of the world would not be devoid of interest to our readers.

The company was incorporated in London on July 10, 1900, and was registered to carry on a general contracting and constructional engineering business. The share capital of the company is £200,000 divided into 150,000 preference shares of £1 each, and 50,000 ordinary shares of £1 each, and it may be noted in passing that for the last two years the dividends declared have been 12 per cent. on the preference shares (the maximum to which they are entitled) and 12 per cent., with a bonus of 10s. per share, on the ordinary shares. The American business was originally formed as a private firm in 1890, but owing to the expansion of the work it was reorganized in 1903 as a Connecticut corporation with increased capital amounting now, we are informed, to some \$3,500,000. The two companies, although separately constituted and entirely distinct organisations, are in intimate and constant touch, resulting in a working basis of material advantage to both. It is unnecessary to enter into the details of this working arrangement, and it will suffice to say that the London firm carries out and controls any works presented to either of the companies in any part of the world except the North American Continent and the possessions of the United States. The works executed by the associated companies cover a very wide field of engineering enterprise and include electric tramways; steam and electric railways; water, harbour, irrigation and drainage works; water power developments; gas lighting, electric light and power, and industrial plants; electric transmission and distribution systems; and constructional engineering works of wide variety. The directors of the London company are J. G. White, chairman, Lord

Arthur Butler, A. N. Connett, W. C. Burton and J. B. White. So much by way of preliminary.

That combination of scientific and business enterprise known as the engineer-contractor, although regarded with little favor by members of professional engineering bodies, is a necessity of modern life. The specialist knowledge of the engineer is of the highest importance and ranks first in any scheme, but the translation of this knowledge—as set forth by pen and pencil—into actuality requires equal knowledge in other directions, in constructional methods for example, in business management and control, and last, but by no means least, in finance. A glance at the components of the huge organisation under consideration will serve to carry conviction on this point. The work of the company falls naturally under five heads: design, contracting and constructional engineering, management, commercial engineering and reporting, and finance. The first three speak for themselves, but on the remainder a few words may be said. As regards commercial engineering and reporting, the company has correspondents and agencies in various parts of the world, and its commercial engineers are in touch with both its construction and management departments, and are ready to examine into and report upon any enterprise, whether existent, in embryo or fully launched. As to finance, the company have brought to them so many enterprises whose financial status requires adjustment, extension or assistance that they have organized a separate department for this phase of their work.

The Cost Insured Contract

The engineer-contractor system has necessarily, as has everything else of a sublunary nature, its drawbacks. To place the whole of an undertaking in the hands of, so to speak, one man, without effective supervision or control, might spell disaster. In the case of a firm of but mediocre reputation, for example, or of one insufficiently supplied with capital or without effective organization, considerable risk might be run were they allowed to work their own sweet will. To the Associated Companies no objection of this nature can apply; none the less they are to be congratulated

on the type of contract which they themselves prefer—one arranged on the basis of actual cost and a fixed fee, with a bonus or penalty, as the case may be, if the estimated sum is reduced or exceeded. Under their contract any excess or reduction is divided in agreed proportion between employer and contractor, whereby the interests of the two are identical. On the one hand, a profit is ensured for the contractor, while on the other the employer obtains the best of work at a minimum of cost.

An Interesting Itinerary

It would be impossible within the space of a single article to deal at all fully with the enterprises undertaken by the Associated Companies. A tour of inspection to cover the more important of these completed or now in progress, would, we are assured, necessitate a journey round the globe and travelling more than 50,000 miles. Such a tour would require about two years, although the average distance between works of interest carried out would be less than 250 miles. The following succinct notes have been furnished to us by a correspondent:

"After inspecting a considerable length of tramways in the Metropolis, the Midlands and Scotland would be visited, followed by a trip to Belfast, where the largest tramway contract ever given in Great Britain was executed. Proceeding thence to Holland, the Amsterdam-Haarlem Electric Railway would be found worthy of study. Then through France (the Lille Tramways) to India, where the tramways and lighting plant at Bombay would claim attention. In Australia there are tramways at Perth and North Melbourne, and a large electric light and power plant at Kalgoorlie, to be seen, and in New Zealand, the fine tramway system of Auckland.

"Crossing to the Philippine Islands the work of J. G. White & Company, Incorporated, would be taken up, and a prolonged stay would be necessary in order to see in all parts of the archipelago the steam railways and harbour works (on various Islands), the electric tramways and lighting of Manila, and the new United States Naval Coaling Station at Olongapo. Taking steamer to San Francisco, numerous undertakings would claim attention in the United States, in Canada and Mexico, including many large water power developments as far separated as California and Maine, and important irrigation works at various places. A trip would also have to be taken to Port Rico and Cuba.

"The study of the contracts of J. G. White & Company, Limited, would be resumed at Cordoba, in the Argentine, and proceeding thence to Buenos Ayres, the Buenos Ayres Central Railway and the extensive system of the Lacroze Electric Tramways would be visited, and, across the River Plate, the important tramways of Montevideo.

"Passing up the coast to Para, after a call at Santos, the visitor would not fail to be struck by the excellent system of tramways and lighting in that city, the extensive drainage works and the new telephone system. Still there would be a journey of nearly 1,000 miles up the mighty Amazon to Manaus, where he would again find a complete system of electric tramways and lighting. Finally, in the extreme north of the South American Continent, the tour would terminate with an inspection of the tramways of Caracas."

Personal Mention

Mr. Allan D. Hazen, the New York consulting engineer who designed the Toronto filtration plant and who has reported for other Canadian cities, was a visitor to Toronto last week.

Mr. Joseph W. Moulding, of the Thomas Moulding Brick Company, Chicago, was elected President of the American Face Brick Association at the second annual meeting of that body held last month at French Lick Springs, Ind.

The gross value of the estate of the late Mr. John Breckenridge, the well-known railway contractor, who died in Calgary last May, is sworn at \$349,843, the net value being sworn at \$248,017. More than half the estate is inherited by his wife.

Municipal Engineers

Mr. H. Talbot-Crosbie, Yorkton, Sask.

YORKTON'S Town Engineer, Mr. H. Talbot-Crosbie, was born at Ardfert Abbey, Ireland, and educated at the Albany Academy in Glasgow. His father is Mr. L. B. Talbot-Crosbie, late of the Royal Navy and at present Deputy-Lieutenant of County Kerry, Ireland. Mr. Talbot-Crosbie made his first connection with engineering as an apprentice with Messrs. Johnstone & Rankine, civil and mining engineers, Glasgow. The period of his apprenticeship extended from 1894 to 1899. During this time he attended classes at the Glasgow University and Technical College. Upon the completion of his pupilage he became associated with the firm of Kyle, Dennison & Frew, Glasgow, proceeding to South Africa in 1900 but returning



Mr. H. Talbot-Crosbie,
Town Engineer of Yorkton, Sask.

the following year to take charge of construction on the Invergarry and Fort Augustus Railway, Invernesshire, Scotland. Mr. Talbot-Crosbie came to Canada in 1902 and soon made connections with Messrs. Mackenzie & Mann by whom he was sent to Nova Scotia on the construction of the Halifax and South-Western Railway. In 1904 Mr. Talbot-Crosbie formed a contract—this time a matrimonial one—and desiring a more settled occupation went west and purchased a farm three miles from Yorkton. In the fall of 1911 Mr. F. McArthur resigned his position as town engineer of Yorkton to become resident sanitary engineer for the province and Mr. Talbot-Crosbie was offered the local appointment, which he accepted. He has the entire charge of engineering works at Yorkton where the present projects include a new water supply from York Lake, four miles distant. Yorkton has not yet attained metropolitan dimensions but it is considered a progressive town with a future. It has a population of 5,200 and boasts of 8.3 miles of water mains, 8.6 miles of sewers and .17 miles of sidewalk. Mr. Talbot-Crosbie is an Associate Member of the Canadian Society of Civil Engineers.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

By a small majority the residents of Montreal west have passed a by-law authorizing the issue of bonds for \$275,000.

Preston property owners have decided in favor of utilizing Trinidad asphaltic concrete paving for the streets as against an alternative suggestion in favor of wood blocks. A long standing controversy has thus reached the settlement stage.

To make way for a modern five-storey warehouse at the southeast corner of King and Frederick streets, the old structure which housed the first bank in Toronto is soon to be pulled down. This ancient building, once the quarters of the Bank of Upper Canada, has stood the test of time for almost a century.

The contention of Mr. Currie, city engineer of Ottawa, that the creosote block for paving purposes is not suitable for our climate would seem to be borne out by the reported failure of these blocks which formed the cover of the new Bank street bridge in that city, and which are stated to have buckled badly as a result of the frost.

The legal department has registered a complaint that the building by-laws of Toronto are being disregarded by certain builders in the city. The complaint had its origin in the recent prosecution of a builder for erecting an apartment house, the rooms of which are alleged to be smaller than the by-law allows.

It is stated that the breakwater being constructed by Sir John Jackson, Canada, Limited, will cost at least \$1,750,000, and that the two piers for which tenders were invited recently, will represent an immediate outlay of over \$500,000. An appropriation of that amount has already been made by Parliament for the work.

Mr. T. H. Jones, city engineer of Brantford, reported at the last city council meeting that five hundred and twenty building permits had been issued during the year, representing a total value of \$1,008,731. This is the largest amount in the history of the city excepting last year, when this total was exceeded by about \$150,000.

Mr. G. Janin, chief engineer of Montreal, states that during the last year approximately twenty miles of paving were laid. This comprised 50,000 square yards of granite blocks, 180,000 of asphalt, 70,000 of artificial blocks, and other material. The record of 1912 was twelve miles of street pavements, in addition to which the city spent nearly a million dollars on new sidewalks. The mileage of streets paved was the largest on record.

Recently the Controllers of Montreal refused to allow a retiring pension of two-thirds of his salary to Mr. G. Janin, chief engineer of the city, on the ground that to increase the ordinary allowance would establish a bad precedent. Mr. J. L. Perron, K.C., has now introduced a motion into the Quebec Legislature amending the Montreal Bill and making it compulsory for the city to pay the higher pension. Mr. Janin has no intention of retiring at present.

Building permits for Toronto fell off some three hundred thousand dollars in November last, as compared with the same month in 1912, but the permits for the eleven months

of 1913 ending November 30 are still ahead of those taken out in the corresponding period of 1912 as indicated by the total of \$25,589,856 against \$25,465,076 for the previous year. These figures indicate that Toronto is bearing up well under the adverse financial conditions that have lessened activity elsewhere.

According to the estimate of Mr. Chausse, building inspector, the total value of building permits issued for Greater Montreal in 1913 totalled nearly forty million dollars. During the same period the buildings erected in Outremont, Westmount, Verdun, Maisonneuve, and other outlying parts forming Greater Montreal totalled about twenty-five millions, the value of the permits issued in December, 1913, being \$1,191,282, as compared with \$685,675 in the same period the previous year.

Next spring will see the inauguration of several important public enterprises in Toronto, involving much building and a huge expenditure on bricks and mortar. The Dominion Government will construct a new Federal building on the site of the present post office as enlarged, and a customs and railway mail building on Front Street will cost nearly a million dollars, and a modern fireproofed registry office will also be constructed. These enterprises taken in conjunction with the new Union station and other important buildings, including a five thousand dollar storage warehouse for the Canadian Pacific Railway being erected at King & Simcoe streets, is estimated to make the public building programme for this year embrace an outlay of eight to ten million dollars.

The new million bushel elevator built for the Canadian Pacific Railway at St. Johns, N.B., is completed and is now in use. Grain conveyors are being constructed on two additional wharves and will be completed by February. The steel frame of the main building of the new sugar refinery has been raised to the full height of ten storeys, and the outer casing of brick is nearly as high, while the enormous chimney has been completed, and other buildings of the group are rapidly going up. The large new armory has been completed, and will be formally opened and occupied by the militia within the next month or two. The large new theatre on King Square, the finest east of Montreal, has been open for some time. The steel frame of the handsome new post office is now being erected, after one of the heaviest pieces of work in preparing a foundation that has been experienced in connection with city buildings for a long time. The street railway company has extended its line to form a circuit of nearly three miles of new track beyond Marsh bridge, and plans have been completed for further extension in the spring. The work of preparing the foundations for the new bridge, said to be the longest spandrel arch bridge in the world, to connect east and west St. John and accommodate both street car and ordinary traffic, is well advanced. The capacity of the big pulp mill near this bridge has been greatly enlarged this year. Three miles from the city, at Coldbrook, an automobile factory has been constructed, and arrangements made for the erection of a large nail and wire factory, while a realty and development company has been providing for water service and streets, and the development of a modern industrial suburb at that place. The work of dredging in the main harbor of St. John has been carried on by a fleet of dredges

throughout the year, and Norton Griffiths & Company now have powerful machines dredging the channel into Courtenay Bay, the eastern harbour, where they have also steadily pushed forward the great breakwater which is to protect the basin, and the dry dock which they are to construct. Building operations in the city, including warehouses, handsome new bank building and alterations and improvements of two others, new residences and cottages, have been on a large scale, and at the close of the year it was announced that several companies were preparing to go into the erection of new houses this year to be sold on easy terms to persons of moderate income, and located in the outskirts within easy reach, by the street railway extensions, of all parts of the city. The city council has laid during the year a large amount of permanent pavement, and on every side are to be seen marked evidence of progress.

WESTERN CANADA

Among Canadian cities Winnipeg takes third place with nearly \$19,000,000 represented in building permits for the past year, while only five cities in the United States show a larger total for the same period.

Writing to the Winnipeg Free Press a correspondent complains of the lack of proper building restrictions in that city. He suggests the appointment by the City Council of a building committee or commission possessing the power to approve or reject all building plans before any progress is made with the proposed work.

Work on the new Parliament Buildings on Broadway Avenue, Winnipeg, is proceeding rapidly, the caisson work being almost completed. Tyndall stone is being used in the building, a feature of which is to be a large dome two hundred feet in height and seventy feet in diameter. The contract price for the building, which will measure 305 feet by 330 feet, is \$2,859,750 and the contract calls for completion in 1917.

The directors of the Edmonton Portland Cement Company have decided to install another kiln at their works at Maryboro', located on the Grand Trunk Railway west of Edmonton. This extension will probably mean an increase of five hundred barrels daily. This company only commenced operations last September and since that time a standing order of one thousand barrels a week have been delivered to the Saskatchewan government.

The large storage dam across the Swift Current River, Sask., capable of supply water for a population of 50,000, was formally opened on December 24 by Mr. J. A. Yager, chairman of the waterworks committee. The dam, which is over eight hundred feet long and twenty-five feet high, was constructed by the Amburse Hydraulic Construction Company of Montreal, under the supervision of Mr. Geo. K. Mackie, town engineer, at an outlay of \$100,000. The capacity when filled will be over 100,000,000 gallons.

Hon. Thos. Taylor, Minister of Public Works, has announced that the new west wing of the Parliament Buildings in Victoria, B.C., will be ready for occupation on January 15, the day set for the opening of the legislature. Work on the east wing and the library will not be completed until next July. The two wings which are for the accommodation of the administrative departments are estimated to cost about a million dollars. In connection with them an interesting feature is a group of statuary representing public men who earned fame in the development of the western province.

Members of the Saskatoon Builders' Exchange are said to be opposed to changing the law governing the filing of liens against buildings by contractors. By an amendment now pending in the legislature at Regina the law will be altered so as to place such liens secondary to mortgages. The

contractors' view is that if the proposed law were to become effective it would practically drive them out of business, consequently the legislative committee of the Builders' organization has had the matter under consideration and a protest against any change will be made to the provincial government.

A bill entitled the "Saskatchewan Land Surveyors' Act," at present passing through the legislature of that province, provides that power be given the Land Surveyors' Association to acquire and hold real estate not producing at any time an annual income in excess of \$5,000. Under the Act by-laws shall be prepared by the executive council and before becoming effective shall be ratified by the association. The examination of candidates for permission to practice as Saskatchewan land surveyors shall be under control of a board of examiners, examinations to be held in Regina in February of each year, but special examinations for permission to practice may be held at any time at the board's discretion on payment of a fee not exceeding fifty dollars. Until the age of twenty-one no person shall practice as a land surveyor in Saskatchewan, and then only when the examinations have been passed and a three year term as an articulated student completed within five years. In addition eighteen months of this term must be spent in the field in actual practice and at least twelve months in the province of Saskatchewan.

Canadian Railroad Development

Apropos of the rumor that the Canadian Pacific Railway had the purchase of the Canadian Northern Railway in contemplation, Sir Donald Mann, vice-president of the latter has stated that it is against the law for the company to sell out to the Canadian Pacific Railway, the government having provided against any such purchase in order to prevent the possibility of monopoly.

A case of much interest to Winnipeg is going on in the Exchequer Court, Ottawa, between the Grand Trunk Railway and the Canadian Northern road. It appears the former have a right of way through St. Boniface to the Canadian Northern Railway bridge over the Red River, and the Canadian Northern Railway claims \$2,500,000 for the property used by the Grand Trunk, part of which belongs to the railway builders personally and part to the railway company. The Grand Trunk's offer is said to be far below the amount claimed, hence the present proceedings.

Hon. Frank Cochrane, Minister of Railways, has signed the agreements which will enable the commencement of work on the important terminal undertakings plant for the city of Quebec. They involve a division between the Transcontinental and Grand Trunk Railway (as lessees of the Canadian Pacific Railway) of millions of dollars of expenditure necessary for the construction of the new Union station and the tunnel to give access to it, as well as the settlement of all matters concerning the construction of the station for the Transcontinental Railway at Champlain Market, and the construction of car shops at St. Malo covering a site of about two hundred acres. The new Union station on the Palais site promises to be one of the finest of its kind in Canada and is to be connected with the St. Lawrence waterfront by a tunnel which will provide not only for the entrance of the National Transcontinental but also for other railways re-

Messrs. J. H. Tromanhauser, of Toronto, and Raoul de B. Corriveau, (District Engineer, Department of Public Works), Ottawa, are both mentioned as candidates for the office of Second Vice-President of the American Society of Engineering Contractors. The election of officers will take place at the annual meeting which is to be held in New York on January 16.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aylmer, Que.

A by-law will be submitted to rate-payers on Jan. 5th providing for concrete sidewalks throughout the town to do away with the existing plank walks. The estimated cost is \$8,000. Mayor, W. G. Mulligan. Town engineer, Mr. Leblanc.

Humboldt, Sask.

By-laws authorizing the expenditure of \$103,500 on waterworks and \$57,700 on sewers have been passed.

Kingston, Ont.

The City Council contemplate laying about two miles new watermains this year. 16-in. or 20-in. pipe will be required for extension to trunk main in west end. General Manager, Civic Utilities, C. C. Folger, Queen Street.

Kindersley, Sask.

Extension to water main is planned by town council. Work for which about 2,000 ft. steel pipe is required to be started in the spring. Tenders will be called shortly. Clerk, D. MacTavish.

Knowlton, Que.

Additions to water system are contemplated by municipal council. Clerk, J. E. Fay.

Ottawa, Ont.

Pavement, George St., planned by city council. Mayor, J. A. Ellis. City engineer, Arch. Currie. Surface drainage completed. Asphalt pavement between Sussex and Dalhousie St. Plans drawn. Tenders to be called early in spring.

Pump cylinder required by city council. Tenders received until Jan. 8th by Sec. Waterworks Committee. Mayor, J. A. Ellis. City engineer, Arch. Currie.

The city council have had surveys made for concrete walks and asphalt pavement on Friel St. from Rideau St. to St. Patrick St., the estimated cost is \$20,000. Mayor, J. A. Ellis. City engineer, Arch. Currie.

Parkhill, Ont.

The town council will be in the market for waterworks main equipment as a large number of new services are to be installed. Mayor, Mr. Harrison. Clerk, J. H. Laughton.

Paisley, Ont.

Extension to waterworks, at an estimated cost of \$5,750, is proposed by village council, and ratepayers will vote on by-law Jan. 5th, providing for new mains and hydrants on several streets. Clerk, J. C. Gibson.

Point Grey, B.C.

An outfall sewer is contemplated by the Corporation, across north arm of Fraser River at foot of Dunbar St. Application filed for approval of Governor-General-in-Council. Plans have been drawn. Clerk, G. G. Heighway, Kerrisdale, B.C.

Ridgeway, Ont.

The sale of debentures for the provision of funds for curbing Ridge St. has been authorized. Reeve, E. Disher. Clerk, M. S. Pound.

Sudbury, Ont.

Storm sewers plans are in course of preparation. Mayor, Mr. Henry. Engineer-in-charge, Mr. Tessier.

Toronto, Ont.

Tenders will be received by Chairman of Board of Control until noon, January 20th, for the following sewers: Lappin Ave., Dufferin St. and Hallam St. Storm Overflow Sewer from Emerson Ave. to Salem Ave., Runnymede Rd., Annette, Main, Gerrard & Hiawatha Rd. and 8th Ave. Plans, etc., at office of Commissioner of Works, R. C. Harris. Chairman, Board of Control, H. C. Hocken.

Vancouver, B.C.

The following work is under consideration by the Municipal Council: Culverts and bulkheads, Ward 6, \$5,000; Ward 7, \$5,000. Grading, Ward 3, \$5,000; Ward 4, \$22,500; Ward 5, \$13,500; Ward 6, \$25,000; Ward 7, \$7,500; Ward 8, \$2,500. Racking streets, Ward 4, \$14,000; Ward 5, \$19,500; Ward 6, \$25,000; Ward 7, \$25,000; Ward 8, \$12,500. Rocking Lanes, Ward 3, \$7,000; Ward 4, \$15,000; Ward 5, \$9,000; Ward 6, \$10,000. Planking streets, Ward 6, \$22,000; Ward 7, \$25,000. Planking Lanes, Ward 4, \$5,000; Ward 5, \$5,000; Ward 6, \$10,000; Ward 7, \$5,000; Ward 8, \$5,000. Engineer, F. L. Fellowes.

Engineer F. L. Fellowes has recommended that Caroline St. be extended from 14th to 16th St. Estimated cost, \$26,711.

The municipal council contemplate laying sewers on Burrard St., \$15,000; Venable St., \$3,000; Campbell Ave., \$2,000; 14th Ave., \$1,665.

The following work has been recommended by City Engineer F. L. Fellowes. Pavement on Parker St. (asphaltic mixture, concrete foundation), \$5,854; Fir St. (asphaltic mixture, concrete foundation), \$12,290; Campbell Ave. creosoted wood block (concrete foundation), \$6,562; 13th Ave. (asphaltic mixture, concrete foundation), \$18,975.

CONTRACTS AWARDED

Toronto, Ont.

Manhole tops, grates, etc., required by Board of Control. Yearly supply awarded to Don Foundry Co., Cherry St. 1910 Standard manhole tops, cover and frame, \$6.85; 18 in. gully tops, \$5.17; large water works tops, etc., \$8.92. Standard Foundry Co., Jarvis St., 24 in. gully tops,

\$8.00. Queen City Foundry Co., 67 Esplanade E., "T" rail track gully grates, \$13.30 each; "girder" rail track gully grates, \$11.30 each. Whyte Railway Signal Co., Ltd., 1884 Davenport Rd., 1911 Standard gully tops, \$4.89; Goss traps, \$2.60; small water works tops, \$2.00.

Sewer pipe required by Board of Control. Yearly supply awarded to Dom. Sewer Pipe Co., Swansea, Ont., 2 ft. length, per ft., 4 in., at 7c; 6 in., at 10c; 9 in., at 21c; 12 in., at 35c; 15 in., at 55c; 18 in., at 75c; 24 in., at \$1.55. One ft. length, per ft., 6 in., at 10c; 9 in. at 21c.

Hydrants required by Board of Control. Yearly supply awarded to: Can. Allis-Chalmers Co., King and Simcoe Sts., 3 way hydrants, \$46.50; 2 way hydrants, \$43.00; frost jackets, \$6.00; 3 way foot pipe, \$7.00.

Stop valves required by Board of Control. Yearly supply awarded to: Aikenhead Hardware, Ltd., Temperance St., 4 in. stop valve with socket, \$14.74; 4 in. stop valve with flange, \$14.74; 6 in. stop valve with socket, \$19.95; 6 in. stop valve with flange, \$19.95; 8 in. stop valve with socket, \$29.44; 8 in. stop valve with flange, \$29.44; 12 in. stop valve with socket, \$58.84; 12 in. stop valve with flange, \$58.84.

Winnipeg, Man.

Sewer castings required by Board of Control. Secretary, M. Peterson. Engineer, H. N. Ruttan, 223 James Avenue. General contractors, Western Steel & Iron Co., Ltd., Elmwood at \$3,554.

Two pumps, \$14,400, required by City Council. Secretary, M. Peterson. Engineer, H. A. Ruttan, 223 James Avenue. General contractors, Dominion Equipment & Supply Co., 46 Canada Life Bldg. Two Deame power pumps complete with motor, capacity 600,000 imp. gals. per 24 hours each.

Wainfleet Twp., Ont.

Drain, cost \$5,000, planned by Twp. Council. General contractors, Brooks & Brooks, care Engineer. Reconstruction of drain 20,000 yds. All hand work. Should require camp equipment. Reeve, P. J. Willson, Marshville P. O. Engineer-in-charge, Geo. Ross, Welland, Ont.

Railroads, Bridges and Wharves

Province of Alberta

The location of G. T. P. station at Coalspur at mileage 36.4 Alta. Coal Branch, Sec. 33-48-21, West 5th Mer. Alta. has been approved.

Bertie Twp., Ont.

The Standard Crushed Stone Co. will probably construct a standard gauge quarry siding about 2000 ft., at an estimated cost of \$4,000. Pres., Robin Boyle, Niagara Falls, Ont.

Colborne, Ont.

The location of C. P. R. station at Colborne, in lot 32, con. 1, Twp. Cramahe, Co. of Northumberland (East Riding), Ont., mileage 105.1, from Glen Tay, has been approved.

Thornbury, Ont.

Harbour improvements, cost \$15,844, planned by Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa. General contractors, N. P. Horton and J. H. Stoddart, Owen Sound.

CONTRACTS AWARDED**Humberstone Twp., Ont.**

Retaining wall planned by Twp. Council. Clerk, A. E. Near, Humberstone P. O. Engineer-in-charge, Geo. Ross, Welland. General contractor, John B. Smith, Humberstone P. O., \$880. 224 ft. long.

Richards Landing, Ont.

Wharf, cost \$30,000, St. Josephs Island, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractors, O'Boyle Bros. Constr. Co. Ltd., 351 Queen St. E., Sault Ste. Marie, Ont. Wharf 180 ft. long x 18 ft. wide, timber crib substructure, concrete block superstructure.

Winterbourne, Ont.

Bridge planned by the Counties of Waterloo and Wellington. Engineers, Bowman & Connor, 36 Toronto St., Toronto and Berlin, Ont. General contractor, P. Pigeon, Stratford, Ont. Concrete girders, reinforced, \$985. Work to start in spring.

Public Buildings, Churches, Schools, etc.**Assiniboia, Sask.**

Board of Ruperra School Dist. No. 812 has been given power to borrow \$25,000 to erect 4-room brick building. Sec. Treas., J. B. Smith, Assiniboia.

Prov. of Alberta

Springville School Dist. No. 2697. Board of Trustees will borrow \$1,200 to erect and furnish building. Treas., L. P. Monson, Loverna, Sask.

The Plain Centre School Dist. No. 2925 Board of Trustees will borrow \$1,200 to erect and furnish building. Treas., Geo. W. Hall, Lost Lake, Alta.

Pine Lake School Dist. No. 2960 Board will borrow \$1,200 to erect and equip new building. Treas., W. R. Charley, Pine Lake, Alta.

Pashly School Dist. No. 3019 Board is authorized to borrow \$1,100 to erect and equip new building. Treas., W. C. Fuller, Pashly, Alta.

Galt, Ont.

Tenders will be received Sec. of Separate School Board, Rev. J. J. Craven, 55 Wellington St., until Jan. 9th for cement, brick, carpentry, plumbing and painting lavatories of separate schools. Architect, J. Evans, Bennett Block.

Hamilton, Ont.

A by-law to raise \$200,000 for hospital buildings was carried January 1st. Chairman Hospital Board, T. H. Pratt. Architects, Stewart & Witton, H. P. & L. Bldg. Adv. Architects, Stevens & Lee, 2 College Street, Toronto.

The by-law for \$125,000 for improve-

ments to City Hospital was carried January 1st.

The ratepayers passed by-law January 1st to raise \$50,000 for new infirmary and \$50,000 for new Southam Home on the Mountain. Mayor, John Allan.

Humboldt, Sask.

The by-law authorizing the expenditure of \$7,500 for improvements to the city hall has been passed. Mayor, C. W. Anderson. Clerk, W. H. Stiles.

Kingston, Ont.

The work on the extension to the Collegiate Institute will not be started until spring. Secretary, Board of Education, Princess and Sydenham streets.

Montreal (Longue Pointe), Que.

New tenders are to be called for a new fire station. Two storeys, 66 x 54, stone and brick construction. The estimated cost is \$50,000. Sec. of Board of Commissioners, L. N. Senecal. Architects, Venne & Labelle, 5 Beaver Hall Sq.

Port Haney, B.C.

The building of a high school is contemplated which will probably be erected in spring. Prov. Govt., Dept. of Education. Supt. of Dept., Dr. Robinson, Victoria.

Port Moody, B.C.

A post office and customs house are contemplated by the Dom. Govt., Dept. of Public Works. Secretary, R. C. Desrochers, Ottawa.

Parkhill, Ont.

Work on the new Carnegie Library will start in spring. The estimated cost is \$10,000. The council will appoint an architect in the near future. Mayor, Mr. Harrison.

Prov. of Saskatchewan

Grand Time School Dist. Board No. 640 will borrow \$1,700 to build and equip new building. Treas., Burdette Trout, Farres, Sask.

The Whitehall School Dist. Board No. 2735 will borrow \$2,500 to build and equip new building. Treas., Ben Osborne, Success, Sask.

The Standing Rock School Dist. 3065 Trustees will borrow \$1,700 to equip and build new building. Treas., W. Saywood, Hazlet, Sask.

The Battrum School Dist. No. 3075 Trustees will borrow \$1,700 to equip and build new building. Treas., S. T. Holdings, Battrum Sask.

Windsor Lake School Dist. No. 3079 Board will borrow \$1,600 to build and equip new building. Treas., Ph. Garnot, Moon Hills, Sask.

The Vanceview School Dist. No. 3082 Board will borrow \$1,800 to build and equip new building. Treas., J. Lambert, Vance, Sask.

The Fir Mountain School Dist. No. 3098 Board will borrow \$1,600 to build and equip new building. Treas., John Gordon, Theresa, Sask.

Dorgan School Dist. No. 2990 Board will borrow \$2,200 to build and equip new building. Treas., J. E. Graham, Theresa, Sask.

Toronto, Ont.

The Public School Board, Sec. No. 22, have decided to add a 6-room addition at

cost of \$25,000. Chairman, W. A. Hall, Swansea, Ont.

On January 1st the ratepayers defeated the by-law to raise \$250,000 for Hospital purposes in the East End.

Ratepayers defeated by-law January 1st to raise sum of \$250,000 for Howard Park Hospital.

The by-law to raise \$600,000 for new machinery hall, sheep pens, dog building, poultry building, judging arena and addition to art gallery, was defeated on January 1st.

CONTRACTS AWARDED**Burnaby, B.C.**

School, \$4,348, planned by School Board. Secretary, A. J. Barham. General contractors, Stide & Patterson, Edmonds, B.C. Hot air heating, plumbing, electric equipment.

Merritt, B.C.

Court House planned by Prov. Govt., Dept. of Public Works. Minister, Hon. Thos. Taylor, Victoria. General contractor, Jas. Layfield, 1024 Broadway St. W., Vancouver.

Armoury, cost \$12,341, planned by Dom. Govt. Dept. of Public Works. Sec., R. C. Desrochers, Ottawa. General contractor, Campbell I. Wilkie, c/o Campbell-Wilkie, 615 Pender St. W. Vancouver.

Business Buildings and Industrial Plants**Dundas, Ont.**

Plans are drawn for additions to the factory of the Valley City Seating Co., Hatt St. (J. D. Pennington). These consist of two storeys, 50 x 50, brick construction, flat roof.

Esquimalt, B.C.

Mr. A. F. Yarrow, of the great ship-building firm bearing his name, has bought out the B. C. Marine Co., and intends establishing a branch here.

Edmonton, Alta.

Business block, Jasper Ave., for E. F. Hutchings, Winnipeg (President of Great West Saddlery Co. Six storeys, 50 x 150, brick construction and foundation. Plans are in progress.

Goderich, Ont.

The Goderich Milling & Lumber Co. are at present negotiating with council for exemptions on their proposed planing mill. Work will probably be done by Co., who will purchase materials, if General Contractor is not engaged. Brick, cement, roofing, shafting, Industrial R/R required. One storey, 200 x 60, concrete and brick construction. Architect, J. Ades Fowler.

Hamilton, Ont.

A soap factory, cost \$12,000, Napier St., is contemplated by H. Schure, 14 Crooks St. Four storeys, 100 x 30, brick construction, concrete and stone foundation, felt and gravel roofing, spruce and pine floors.

London, Ont.

By-law granting loan of \$25,000 to Grobb Mfg. Company for addition to plant was defeated January 1st.

Montreal, Que.

Store and flats, cost \$5,000, City Hal-

and Pine, for M. Rubenstein, 3 Ontario St. W., who will receive tenders for general contractor about Feb. 1st. Three storeys, 24½ x 47, stone and brick construction. Plans drawn.

Hutchison, Wood & Miller, Royal Ins. Bldg., Montreal, are still open to receive tenders for replacing wall recently destroyed at R. MacFarlane & Co.'s premises at St. James and Richmond Sts.

Tenders have been called for alterations to picture theatre, cost \$5,000, Aylmer and St. Catherine, but nothing definitely is decided on. Architect, D. J. Crighton, 282 St. Catherine W.

Hotel, cost \$15,000, Snowdens Jct., is contemplated by Beaudry Realty Co., 211 McGill St. Architect, A. Brassard, 9 St. James St. Matter to be definitely decided shortly.

Ottawa, Ont.

Jackson Booth and syndicate, Metcalfe St., have plans in progress for the erection of a four-storey building comprising theatre, stores, etc., the estimated cost of which is \$175,000.

Alterations to store, Somerset, are contemplated by Amroy Bookman, 589 Bank St. Solid brick construction, stone foundation, electric lighting, birch floors, fronts and fixtures.

Preston, Ont.

Hotel plans have been drawn by Architects, Cowan & Cowan, Berlin. The proposed building will have 50 apartments.

St. George, N.B.

The St. George Pulp & Paper Co., South St., contemplate enlarging pulp mill; it is understood they may also erect paper mill.

St. Thomas, Ont.

The committee has recommended that 27 new hydrants be placed on certain streets. Ald. Trott, chairman; Mr. M. Ferguson, city engineer; and Chief Henderson.

St. Catharines, Ont.

Store, cost \$5,000, St. Paul St., for Wood Bros., St. Paul St. Architect, T. Wiley, St. Paul St. Tenders received by architect until Jan. 10th. Three storeys, 22 x 56, stone and pressed brick construction, stone and brick foundation, felt and gravel roofing, electric lighting, steam heating, maple floors, metal ceilings, interior slate, plate glass, store fronts and fixtures.

Tillsonburg, Ont.

Mervin & Minshall, cor. Oxford and Broadway, contemplate remodelling store and office building at a cost of \$5,000. Basement to be put in, store fronts, office equipment.

Toronto, Ont.

Storehouse, cost \$8,000, Greenwood, for A. H. Wagstaff, 362 Greenwood Ave. Architect and general contractor, H. Baxter, 50 Jones Ave. General contractor will sublet. Two storeys, 32 x 120, brick and steel construction, brick foundation, electric lighting, steam heating, birch and concrete floors, lime and sand plastering, wood lath. Plans drawn.

Vancouver, B.C.

Rebuilding warehouse, cost \$40,000, a permit has been issued to Kelly-Douglas & Co., wholesale grocers, 367 Water St. Architect and general contractor, J. M. McLuckie, 821 Pender St. W., for the

rebuilding of their warehouse, which was recently destroyed by fire, at an estimated cost of \$40,000.

Windsor, Ont.

Plans are in progress for an addition to the soap factory of J. T. Wing & Co., Pitt St. E. Manager, John Stewart. The proposed additions consist of two storeys, 100 x 100, brick and steel construction, and the estimated cost is \$30,000. Architect, J. C. Pennington.

CONTRACTS AWARDED

Calgary, Alta.

Stores and offices, cost \$20,000, 17th Ave. and 4th St. W., for Mr. T. Vandellinder. Architect, J. E. Burrell, 6th Ave. and Centre St. General contractor, A. A. Rose, David Bldg. Two storeys, 60 x 64, concrete foundation, hollow tile, steel and brick veneer construction, felt and gravel roofing, electric lighting, steam heating, fir floors, plumbing, hard wall plaster, wood lath, skylights, cornices.

North Edmonton, Alta.

Dairy for J. A. Smith. General contractor, R. G. Stanton, 148 Morris St. Work to start in spring. Dairy equipment required.

South Edmonton, Alta.

Dairy for J. Stanton. General contractor, R. G. Stanton, 148 Morris St. Work to start in spring. Dairy equipment required.

Residences

Edmonton, Alta.

Four residences, cost \$12,000, for S. H. Rowswell. Architect and general contractor, R. G. Stanton, 148 Morris St. 2½-storeys, 22 x 28, frame construction, brick foundation, shingle roofing, electric lighting, hot air heating, maple and fir floors, wood fibre plastering, one built in fireplace. Plans drawn.

East London, Ont.

Three residences, cost \$6,000, contemplated by Bert Weir, 493 Adelaide Street. Frame and white brick construction, shingle roofing, electric lighting, pine and maple floors, plumbing, lime and sand plastering.

West London, Ont.

Residences, cost \$10,000, contemplated by W. J. Clark, 496 Ridout St. 1½ storeys, frame and white brick construction, shingle roofing, electric lighting, maple and pine floors, plumbing, lime and sand plastering. Architect to be selected.

Ottawa, Ont.

Residence, cost \$5,500, is contemplated by J. B. Davis, 272 Clarence St. 2½-storeys, 27 x 44, brick veneer construction, stone foundation, shingle roofing, electric lighting, hot air heating, birch and spruce floors, water heaters, lime and sand plastering, built-in fireplaces.

Residence, cost \$5,000, is contemplated by T. J. Somerville, 196 Arlington. 2½-storeys, 34 x 36, double brick veneer construction, stone foundation, shingle roofing, electric lighting, hot air heating, birch floors, water heaters, lime and sand plastering, built-in fireplaces.

Sandwich, Ont.

Residence, cost \$14,000, River Front, for R. M. Morton, Windsor. Architect,

J. C. Pennington, Windsor, who will receive tenders from Jan. 2nd to 17th. Two storeys, 30 x 54, hollow tile and stucco construction.

Toronto, Ont.

One pair residences, \$5,000, Gothic. Owner and general contractors, Cromar & Hamm, 86 Clara St. 2½ storeys, 36 x 42, brick construction and foundation, shingle, felt and gravel roofing, gas and electric lighting, hot air heating, oak and pine floors, lime and sand plastering, wood lath, built-in fireplaces, mantels. Plans drawn.

One pair stores and residences, cost \$4,500, Royce Ave. Owner and general contractor, M. Smith, 49 Ward St., who will superintend construction. Two storeys, 38 x 46, brick and steel construction, stone foundation, felt and gravel roofing, gas and electric lighting, hot air heating, birch, oak and spruce floors, lime and sand plastering, wood lath, plate glass, store fronts and fixtures, mantels. Plans drawn.

Windsor, Ont.

Residence, cost \$12,000, Victoria, for Walter Bartlett. Architect, J. C. Pennington. 45 x 50, hollow tile and stucco construction. Plans in progress.

CONTRACTS AWARDED

Toronto, Ont.

One pair stores and residences, cost \$4,000, St. Clair Ave, for Max Helfand, 6 Casimir St. General contractors, Rosenfeld Bros., 572 Annette St. Two storeys, 36 x 55, brick and steel construction, stone foundation, felt and gravel roofing, gas and electric lighting, hot water heating, birch, oak and pine floors, lime and sand plastering, wood lath, plate glass, store fronts and fixtures, mantels.

Power Plants, Electricity and Telephones

Hamilton, Ont.

The by-law to raise \$335,000 for extension of Hydro System was carried January 1st.

Power station, near Stewart Park, planned by Dom. Power & Transmission Co. Supt., Geo. E. Waller. Managing director, W. C. Hawkins. Work will be started soon on new auxiliary power plant to generate 88,000 h.p. Estimated cost \$3,500,000.

Humboldt, Sask.

A by-law providing for electric light extension at a cost of \$20,500, has been passed by ratepayers. Mayor, C. W. Anderson. Clerk, W. H. Stiles.

Milverton, Ont.

The village council has been asked by Board of Trade to submit by-law to ratepayers authorizing the installation of a fire protection system. Clerk, W. D. Weir.

Parkhill, Ont.

The Town Council will take up at once the question of the installation of the Hydro-electric System. Mayor, Mr. Harrison.

Port Arthur, Ont.

The following tenders were referred to the Commissioner for report: Ottawa Car Co., 3 single truck, wooden cars, at \$5,-

(Continued on page 44)

Tenders and For Sale Department

City of Ottawa, Dominion of Canada

Tenders for Steel Pipes

Sealed tenders in duplicate addressed one copy to the City Clerk, City of Ottawa, Canada, and the other to Sir Alex. Binnie Son & Deacon, St. Stephens House, Westminster, London, Eng., and endorsed "Tenders for Steel Pipes," will be received until 4 p.m. on Tuesday, the 3rd day of February, 1914, for about forty-two miles of steel pipe, fifty-four inches internal diameter, about thirty-two miles of steel pipe fifty-eight inches internal diameter, and about eleven miles of steel pipe, fifty-one inches internal diameter.

Forms of tender and specification may be obtained from Sir Alex. Binnie Son & Deacon, St. Stephens House, Victoria Embankment, London S.W., or from the City Engineer of Ottawa, Canada, on and after the fifteenth on receipt by them of a cheque to the value of five hundred dollars made out to the City Treasurer of the City of Ottawa, Canada, which sum will be returned on receipt of a bona fide tender.

The lowest or any tender is not necessarily accepted.

No tenders will be considered except from actual manufacturers capable of supplying the whole of the pipes within a period of two and a half years from the date of acceptance of the tender.

SIR ALEX. BINNIE SON & DEACON,
Engineers in Chief,
St. Stephens House,
Westminster, London, Eng.
Dated December 4th, 1914. 51-52-53-1



Sealed tenders addressed to the undersigned, and endorsed "Tender for Addition to Refinery, Royal Mint, Ottawa, Ont.," will be received at this office until 4 p.m., on Wednesday, January 14, 1914, for the above mentioned addition.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, December 24, 1913.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47485.

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent., an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929, Contract Record, Toronto, 53-12

CITY OF MOOSE JAW

Tenders for Street Signs and Numbers

Sealed tenders marked "Tender for Street Signs and Numbers," will be received by the City Commissioners up to 12 o'clock noon on Saturday, January 17th, 1914, for furnishing the City of Moose Jaw with street signs and numbers, in accordance with specifications on file in the office of the said Commissioners.

The lowest or any tender not necessarily accepted.

JAMES PASCOE,

L. W. RUNDLETT, City Commissioners.

W. F. HEAL,

Moose Jaw, December 27th, 1913. 1



Sealed tenders addressed to the undersigned, and endorsed "Tender for Additions to Fuel Testing Plant, Ottawa, Ont.," will be received until 4 p.m., on Monday, January 26, 1914, for the above mentioned Additions to Fuel Testing Plant, Ottawa, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, January 3, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 51742. 1-2

CRUSHED LIMESTONE

We offer a splendid Crushed Limestone proposition. Railroad switches now in. Write us.

1 Longford Quarry Company, Limited,
Longford Mills, Ont.

WANTED

A Small Thew Shovel.

Apply

Credit Forks Tile & Brick Co.,
262 Yonge St., Toronto.

53-1



Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, January 20th, 1914, for the construction of the following sewers, viz:—

Lappin Ave., Dufferin St. and Hallam St. Storm Overflow Sewer from Emerson Ave. to Salem Ave.

Runnymede Road, from Annette St. to St. Clair Avenue.

Annette St., from Jane St. to Runnymede Road. Main Street, from Gerrard Street to North City Limits.

Gerrard Street and Hiawatha Road to Gerrard Street and Eighth Ave., via Gerrard Street, Coxwell Avenue and Gerrard Street.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,

Chairman, Board of Control
Toronto, December 30th, 1913. 1

Power Plants, Electricity and Telephones

(Continued from page 43)

451 each; steel cars at \$5,698, f.o.b.; Tillsonburg Electrical Car Co., Ltd., at \$4,526 each, and Preston Car Co., at \$4,954 each. Also tenders of the Canadian Westinghouse Co. for 101 B. motors at total of \$1,518; air brakes at \$335, and of the Ottawa Car Co. for truck at \$413; life guards \$25; headlights \$46, etc. Commissioner of Utilities, J. J. Hackney.

Wilkie, Sask.

A by-law is to be submitted to the rate-payers by town council in the near future providing for extension of electric lighting system. Sec.-Treas., T. A. Dinsley.

Yarmouth, N.S.

The special committee recommends that contract be given to the Northern Electric & Mfg. Co. of Montreal for apparatus, etc., for 3 circuit system, compressed air plant, 60 cycle, 3-phase, 220 volt circuit air compressors, motors, etc., \$2,000; battery switchboard, etc., \$1,587; wire, labor, etc., \$425.

Miscellaneous**Knowlton, Que.**

Municipal Council will shortly be purchasing a road roller. Sec.-Treas., J. E. Fay.

London, Ont.

The necessary by-law having been carried, Greene Swift Co., of Carling Street, will now be allowed to lay steam pipes for heating throughout streets in business section.

Ottawa, Ont.

City Engineer, Arch. Currie, reports that it is advisable to erect another incinerator and approximates the cost at \$50,000. Mayor, J. A. Ellis.

Quebec, Que.

Copper wire required by city council. Mayor, N. Drouin. Tenders received by Supt. until Jan. 13th for 20 miles copper wire, 350 lbs. to the mile, 2 small alarm gongs of 5 in. diameter; 2 alarm gongs,

14 in. diameter, electrically operated and worked by weight. Further information from Supt Fire Alarm Dept., Auguste Malouin, City Hall.

Winnipeg, Man.

Birks Jewelry Co., Portage Ave., contemplate installing elevator in their 3-storey building.

CONTRACTS AWARDED**Toronto, Ont.**

Crushed limestone required by Board of Control. Yearly supply awarded to Canadian Quarries, Ltd., $\frac{3}{8}$, $\frac{3}{4}$ and 1 in., at \$1.30 per ton; 2 in. and 3 in., at \$1.25 per ton. Rogers Supply Co., in bins, $\frac{3}{8}$, $\frac{3}{4}$ and 1 in., at \$1.50 per ton; 2 in. and 3 in., at \$1.40 per ton.

Brass and bronze castings required by Board of Control. Yearly supply awarded to Canada Metal Co., Fraser Ave., phosphor bronze, 22c per lb.; babbitt, 12c per lb. Dominion Bronze Co., Tobin bronze, 22c per lb. Martin Pump & Machine Co., 47 Davies Ave., brass castings, 19c per lb.

Sand, yearly supply required by Board of Control. General contractors, Sand & Supplies, Ltd., Spadina Ave., \$1.50 per cu. yd.; Smyth & Ryan, from \$1.50 to \$2.00 per cu. yd.; York Sand & Gravel Co., 75c and 88c per ton; Maple Sand, Gravel & Brick Co., 75c per ton.

Limestone dust required by Board of Control. General contractors, Canada Floors, Ltd., Stair Bldg. \$4.90 per ton.

Gravel, yearly supply required by Bd. of Control. General contractors, Sand & Supplies, Ltd., Spadina Ave., screened

gravel, 2-in., \$1.20 per ton; Maple Sand, Gravel & Brick Co., screened gravel, 2-in., \$1.05 per ton, pea gravel, \$1.10 per ton; York Sand & Gravel Co., pit run unscreened, 75c and 88c per ton; Smyth & Ryan, pit gravel, from \$1.50 to \$2.00 per ton.

Cement required by Board of Control. Yearly supply Portland cement awarded to Canada Cement Co., Ltd., Temple Bldg., at \$1.40 per barrel.

Business Notes**Bolton, Ont.**

Barn and implements of Russell Williamson on Albion and King townline have been completely destroyed by fire.

Coaticook, Que.

Factory of A. O. Norton, mfrs. high speed jacks, has been destroyed by fire. Loss is estimated at \$45,000.

Grafton, Ont.

Canadian Pacific Railway Co. station, new building, nearing completion, destroyed by fire.

Jarvis, Ont.

Apple evaporator of Johnson Bros. destroyed by fire. Estimated loss \$6,000, which is partly covered by insurance.

Maillardville, B.C.

R. C. Church and contents have been totally destroyed by fire. Loss about \$10,000. Insurance \$4,000. Priest in charge, Rev. Father Garon.

Montreal, Que.

Manufacturing block, 867 St. Lawrence,

Canada Lumberman

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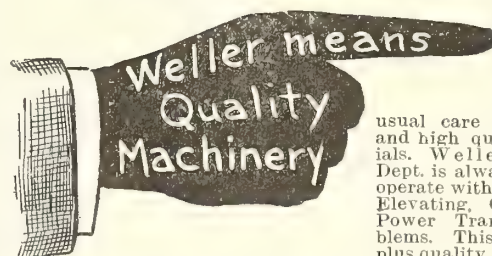
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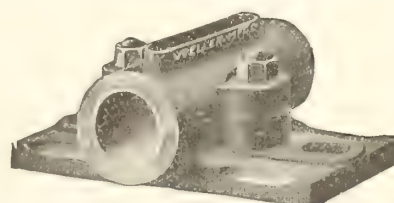
usual care in construction and high quality of materials. Weller Engineering Dept. is always ready to co-operate with you on all your Elevating, Conveying and Power Transmission problems. This means service, plus quality.

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occupied by Lux & Rosenstem, clothing factory; National Waist Co.; Millar Clothing Co.; National Stove Mfg. Co.; Warnick Clothing Co.; Grothe & Juneau. Destroyed by fire; estimated loss \$90,000.

Garage occupied by Auto Garage Co., Ontario and Providence, and some adjoining buildings destroyed by fire. Loss \$285,000; insurance \$40,000.

Ottawa, Ont.

Store and residence, Queen St., for Ald. McNeil, 136 Bank St., destroyed by fire. Loss \$3,000.

Sherbrooke, Que.

St. George Club, Dufferin Ave., has been ramaged by fire; the loss is estimated at \$10,000.

New Companies

The Gaffney Construction Co., Ltd., has been incorporated with a capital of \$200,000, with head office at Montreal, to carry on business as general builders and contractors. The provisional directors are Henry Gaffney, of Montreal, builder; C. E. H. Freeman, T. Moss and C. F. Ritchie, barristers, of Toronto.

The Alberni Development Company, Limited, has been incorporated with a capital of \$10,000, with head office at Vancouver, B.C., to carry on business as a general land and building company.

Inland Waterways Construction Company, Ltd., has been incorporated with a capital of \$10,000, with head office at Chase, B.C., to carry on business as general contractors.

New Ontario Pressed Brick Company, Ltd., has been incorporated with a capital of \$150,000, with head office at Sudbury, Ont. The provisional directors are C. A. Durkee, E. T. Lansdowne and I. Proctor.

Vendome Boulevard and Lands Company, Ltd., has been incorporated with a capital of \$650,000, with head office at Montreal, Que., to carry on business as a general land and building company. The provisional directors are W. G. Mitchell, advocate, R. Chenevert, advocate, F. Callaghan, advocate, P. Gregory, accountant, all of Montreal, Que.

The Star and Hydro-Electric Company, Ltd., has been incorporated with a capital of \$399,000, with head office at Montreal, to carry on business as electricians and manufacturers. The provisional directors are F. W. Themens, agent, J. E. Archambault, financier, C. D. Fagenberg, broker, G. E. Antrobus, real estate agent, and L. P. Fournier, advocate, all of Montreal.

The British Home Building Co., Ltd., has been incorporated with a capital of \$150,000, with head office at Toronto, to carry on business as a general land and building company. The provisional directors are J. Hughes, chartered accountant, W. L. Clerk and H. R. Turner, real estate brokers, and H. T. Goodman and J. P. White, solicitors, all of Toronto.

Home Construction Company, Limited, has been incorporated with a capital of \$50,000, to carry on business as a general land and building company, with head office at Montreal. The provisional directors are T. B. Gould, bookkeeper, T. H. Coonan, secretary, both of Montreal.

Concrete Builders, Limited, has been incorporated with a capital of \$50,000, with head office at Oshawa, Ont. The

provisional directors are A. E. Law, T. B. Mitchell and D. S. Hoig.

Vaughan Sand & Gravel Co., Ltd., have been incorporated with a capital of \$100,000, with head office at Toronto, to carry on business as sand, gravel and cement merchants. The provisional directors are T. W. Murray, broker, R. Richardes, accountant, W. Fairburn, machinist, and G. Cooper, barrister, all of Toronto.

Mount McKay Products, Ltd., has been incorporated with a capital of \$600,000, to carry on business as general contractors and builder's merchants, with head office at Fort William, Ont. The provisional directors are A. H. Davidson and W. C. McLean, managers, L. Y. McIntosh, physician, and J. R. Lumby and A. McIsaac, agents, all of Fort William, Ont.

Canadian Fireproofing Co., Ltd., has been incorporated with a capital of \$250,000, to carry on business as manufacturers of fireproof flooring, etc., with head office at Quebec. The provisional directors are A. Chase-Casgrain, E. M. McDougall, J. J. Crulman, G. S. Stavis, and P. F. Casgrain, advocate, all of Montreal.

British Pacific Engineering and Construction Company, Limited, has been incorporated, with a capital of \$25,000, with head office at Vancouver, B.C., to carry on business as engineers and general contractors.

Saint Marguerets Gravel Company, Limited, has been incorporated with a capital of \$20,000, with head office at Saint Marguerets, Que., to carry on business as gravel merchants and general contractors. The provisional directors are S. G. Hyman, manager, H. Day, accountant, of Montreal, Que.; G. F. W. Vezey, manager, Saint Marguerets, Que.; J. G. D. Bryant, bookkeeper, and C. W. Mills, manager, of Montreal, Que.

The Rigaud Granite Company, Limited, has been incorporated with a capital of \$250,000, with head office at Montreal, to carry on business as granite and stone merchants. The provisional directors are E. Fabre, Surveyor, of Outremont, Que.; C. G. Ogdon, advocate, P. S. Conroy, notary, and R. H. Teare, all of Montreal, Que.

Begin Manufacturing Company, Limited, has been incorporated, with a capital of \$49,000, with head office at Victoriaville, Que., to carry on business as engineers and manufacturers of cast iron, etc. The provisional directors are W. Begin, M.D., G. Begin, manufacturer, of Windsor Mills, J. C. Heon, trader, J. A. Beauschene, notary, and A. G. Letourneau, trader, of Victoriaville.

Frankman & Company, Limited, have been incorporated with a capital of \$50,000, with head office at Winnipeg, Man., to carry on business as builders and contractors. The provisional directors are John Frankman, bridge contractor, F. J. Sutton, barrister, and Gustav Blom, accountant, all of Winnipeg, Man.

The Robertson Building Company, Limited, has been incorporated with a capital of \$20,000, with head office at Winnipeg, Man., to carry on business as a general land and building company. The provisional directors are N. Robertson, manager, H. G. Morson, T. L. Harrison, and J. E. Flack, real estate agents, and W. S. Boyd, barrister, all of Winnipeg, Man.

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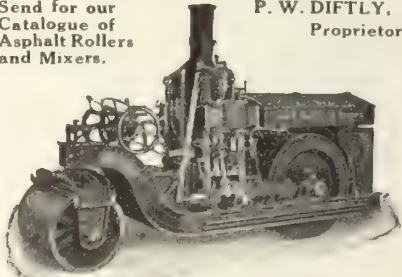
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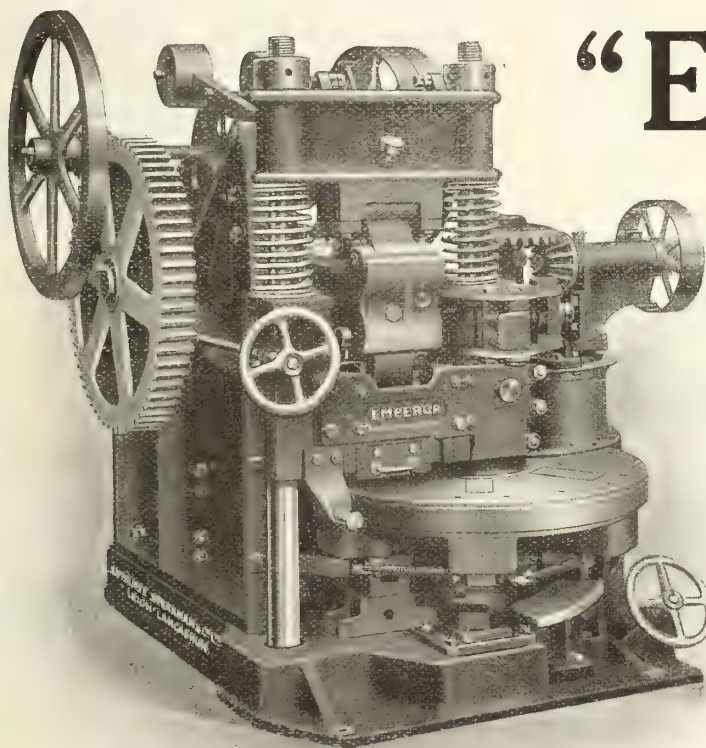
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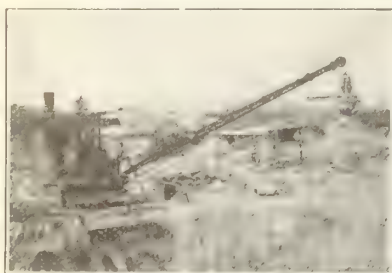
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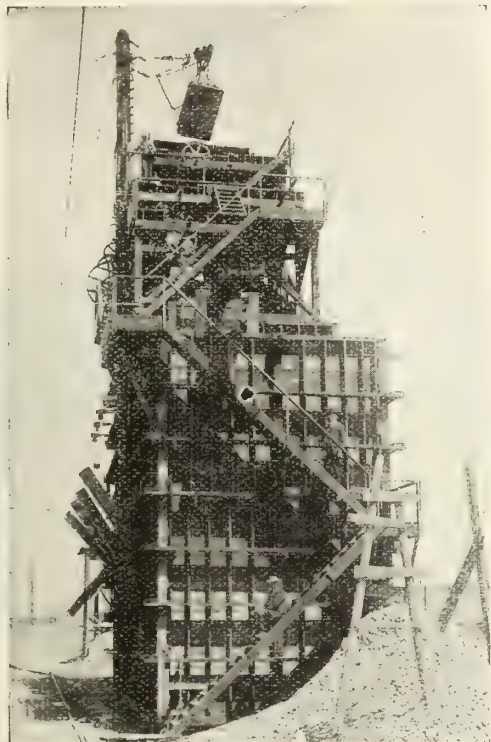
Length	Size	Length	Size	Length	Size	Length	Size
60 ft.	12 in. x 15 in.	23 ft.	13 in. x 14 in.	52 ft.	13 in. x 14 in.	38 ft.	12 in. x 14 in.
41 ft.	18 in. x 20 in.	33 ft.	15 in. x 15 in.	51 ft.	18 in. x 19 in.	31 ft.	13 in. x 13 in.
40 ft.	19 in. x 20 in.	43 ft.	18 in. x 19 in.	48 ft.	15 in. x 16 in.	31 ft.	14 in. x 16 in.
32 ft.	12 in. x 15 in.	60 ft.	14 in. x 15 in.	44 ft.	14 in. x 15 in.	35 ft.	14 in. x 15 in.
24 ft.	15 in. x 16 in.	44 ft.	18 in. x 18 in.	43 ft.	18 in. x 19 in.	39 ft.	18 in. x 18 in.
34 ft.	12 in. x 14 in.	43 ft.	16 in. x 16 in.	34 ft.	13 in. x 13 in.	41 ft.	17 in. x 18 in.
25 ft.	14 in. x 14 in.	38 ft.	13 in. x 15 in.	30 ft.	14 in. x 15 in.	42 ft.	16 in. x 18 in.
28 ft.	14 in. x 13 in.	41 ft.	12 in. x 13 in.	21 ft.	15 in. x 16 in.	41 ft.	14 in. x 15 in.
32 ft.	12 in. x 14 in.	37 ft.	13 in. x 14 in.	23 ft.	19 in. x 20 in.	38 ft.	13 in. x 14 in.
28 ft.	16 in. x 16 in.	43 ft.	16 in. x 16 in.	29 ft.	17 in. x 19 in.	27 ft.	14 in. x 17 in.
29 ft.	16 in. x 16 in.	47 ft.	16 in. x 17 in.	34 ft.	14 in. x 15 in.	44 ft.	14 in. x 15 in.
31 ft.	14 in. x 13 in.	43 ft.	15 in. x 16 in.	35 ft.	14 in. x 17 in.	40 ft.	13 in. x 13 in.
33 ft.	13 in. x 14 in.	39 ft.	14 in. x 14 in.	35 ft.	15 in. x 15 in.	41 ft.	13 in. x 14 in.
33 ft.	13 in. x 14 in.	41 ft.	13 in. x 15 in.	31 ft.	12 in. x 13 in.	39 ft.	13 in. x 13 in.

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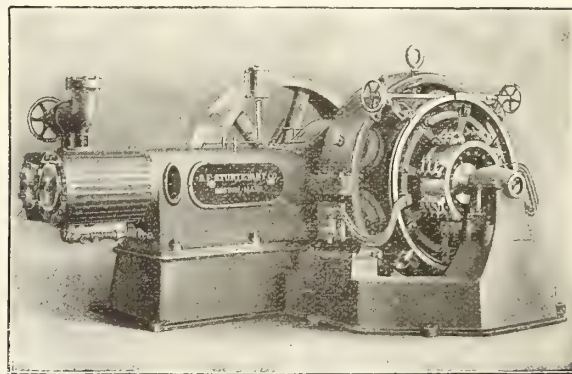
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says the owner of the crane shown here. This crane is being used with a 2 yd. Brownhoist Patent Grab Bucket for handling sand, gravel, and crushed stone from and to cars, stock-pile and wagons.

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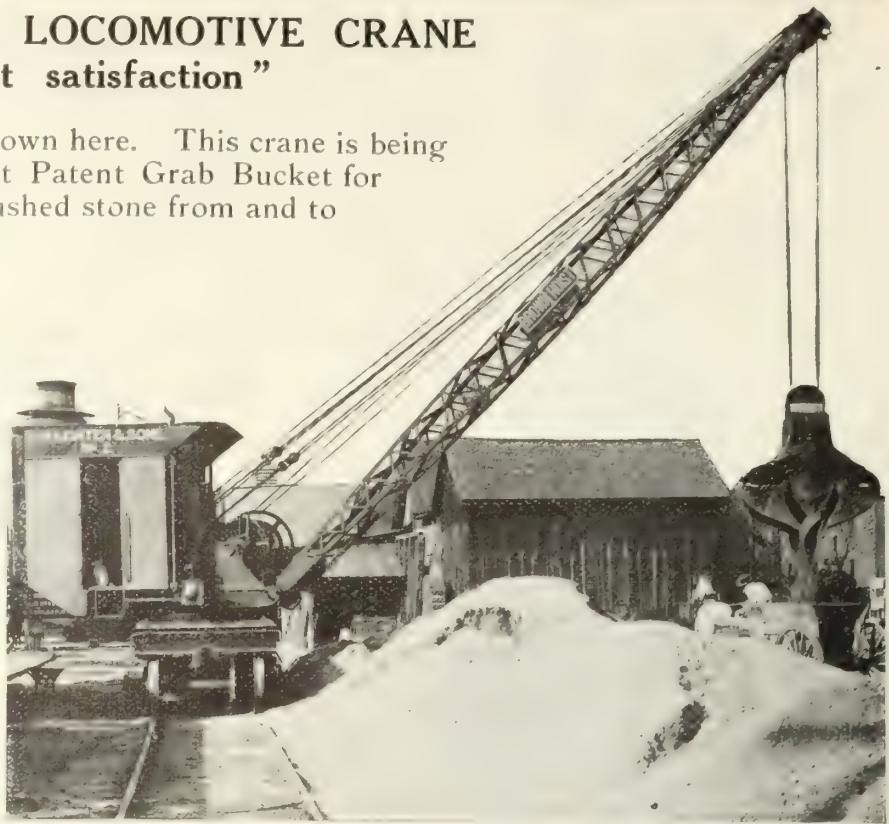
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**THE
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MACHINERY CO.
Cleveland, O.**

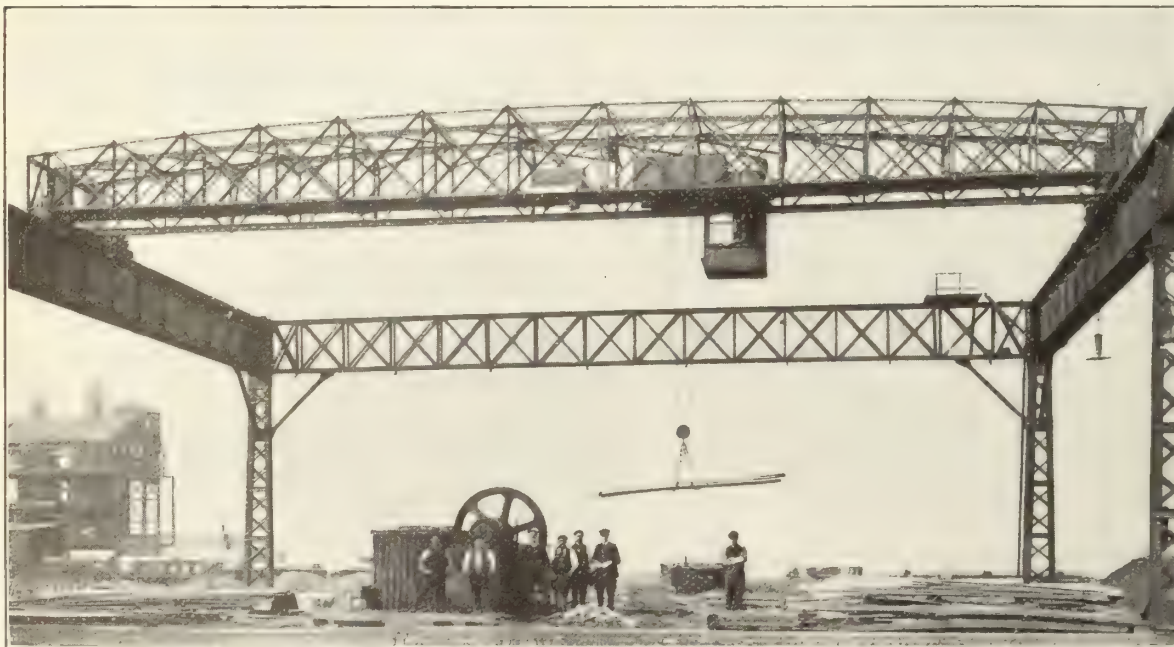
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Note that the bucket is opened only so far and no sand is spilling over the sides of the wagon. This fine operation is obtained with all Brownhoist Locomotive Cranes and buckets.



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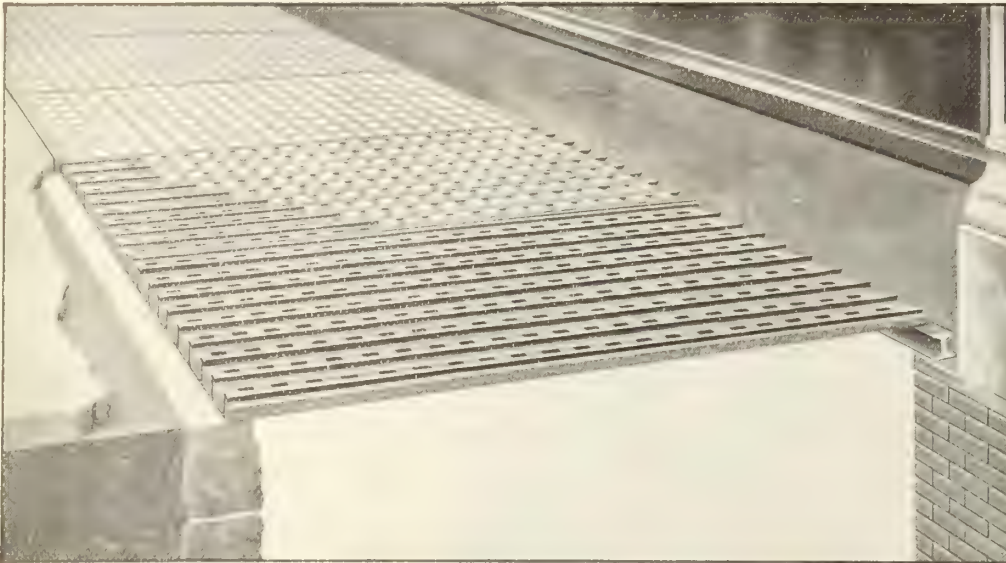
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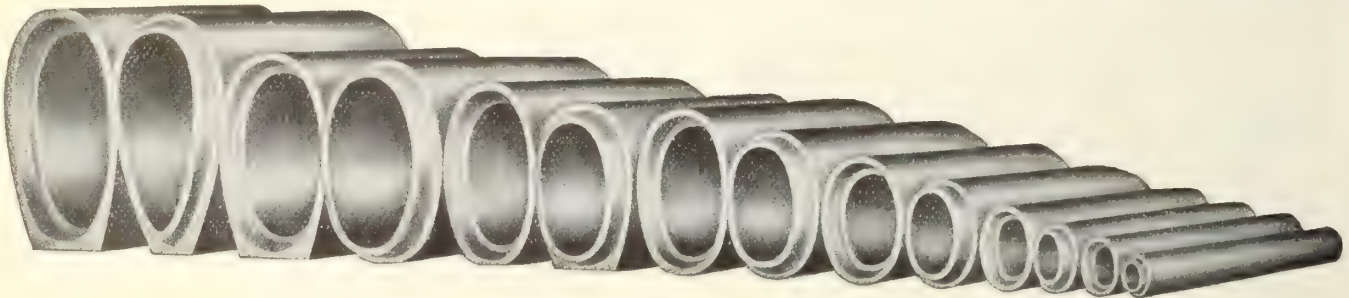


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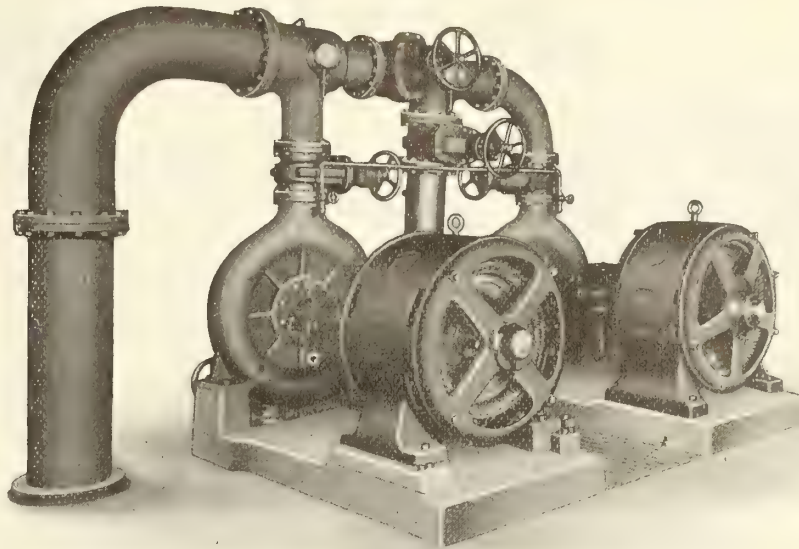
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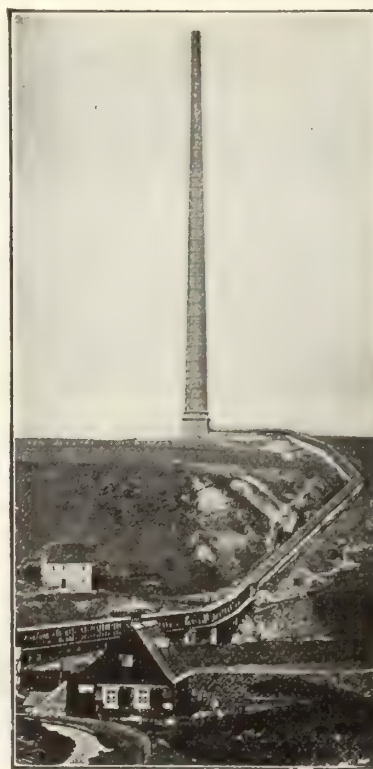
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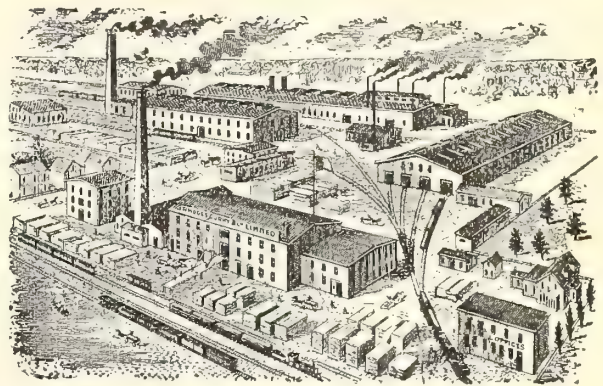


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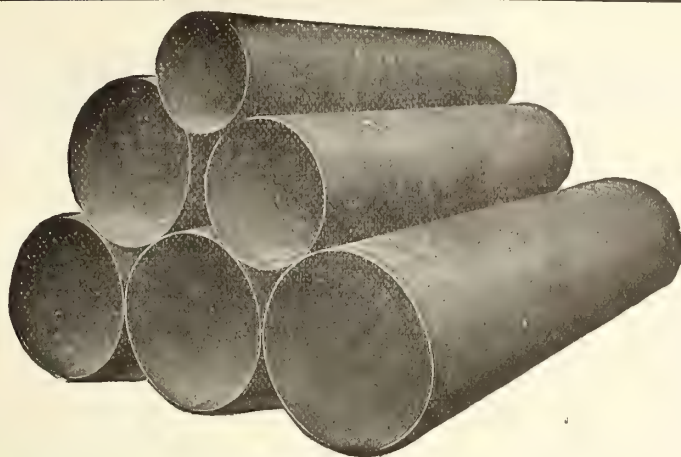
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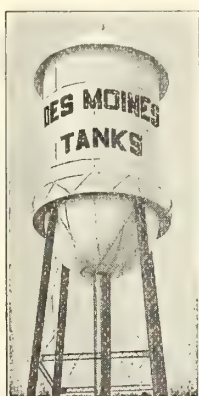
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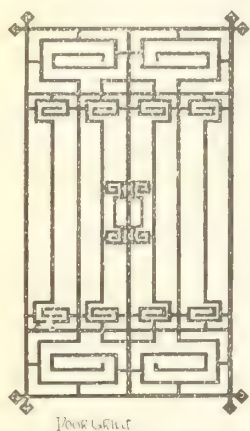
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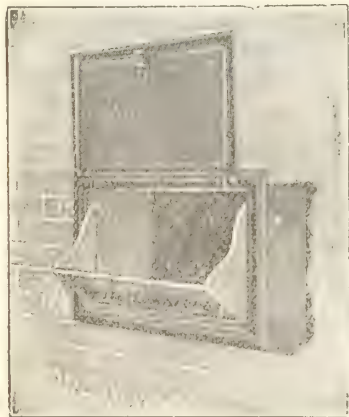
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Contractors who buy numbers of Hoists usually have to be convinced that what they are getting is “O. K.”

The closer they examine and watch BEATTY HOISTS under severest conditions — the better pleased they are.

Their use spells SATISFACTION.

The reason? The material, design and workmanship “are there.”

We are building for the future—both yours and our own.

If you place one BEATTY HOIST on your work, you’ll eventually buy more.

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For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

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GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

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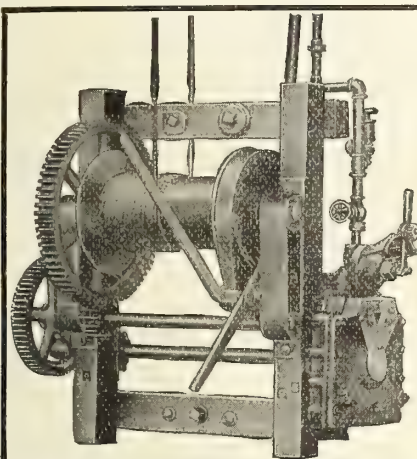
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as well as Rough Quarried Blocks, Dimension
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Current Prices of Building Material

BRICKS

The following are wholesale prices delivered at Toronto:

	Per M.
No. 1 dry pressed red brick	\$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	13 00
Wire cut bricks for foundation work	12 50
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	\$80 00 to \$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—	
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	\$26 00
2 x 4 to 2 x 12, 16 ft.	26 00
2 x 4 to 2 x 12, 18 ft.	29 00
1 in. Hemlock, No. 1	25 00
No. 1 Hemlock Decking	25 00
No. 2 Hemlock dimension and 1-in.	19 00

Pine—	
1 in. common pine 8 to 12 in. wide	26 00
1 in. tough	30 00
2 in. white pine Bill stock	29 00
7/8 x 8 and 10 in. pine shelving	30 00
7/8 x 12 in. pine shelving	45 00
No. 1 white pine flooring	33 00
No. 1 spruce flooring	28 00
No. 1 pine decking D2S	30 00
Spruce Decking	28 00
No. 1 pine V. or headed sheeting	36 00
No. 2 pine V. or beaded sheeting	32 00

Pine trim for paint finish—	
4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—	
XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—	
5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:	
8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$ 6 25
26 to 40 "	4 00	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

	Star	D.D.
25	\$3 25	\$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	\$3 50	\$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 60 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent.; and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 10 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net\$1.85
No. 4 1/2 Fuller's net\$2.35
Square head brass cocks, 65 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6 1/2 cents per lb.; traps and bends, 40 per cent.; pig lead, 6 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black	Galvanized
1/4 inch	\$2.16	3/4 inch .. \$3.06
3/4 "	2.16	3/4 " .. 3.06
1 "	2.72	1/2 " .. 3.57
1 1/2 "	3.11	3/4 " .. 4.26
2 "	4.59	1 " .. 6.29

1 1/4 "	6.21	1 1/4 "	8.51
1 1/2 "	7.43	1 1/2 "	10.18
2 "	9.99	2 "	13.19
2 1/2 "	16.38	2 1/2 "	22.23
3 "	21.43	3 "	29.7

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67 1/2; nipples, 4-inch diameter and under, 75 and 10; nipples, 4 1/2-inch and up, 70 and 10; malleable lipped unions, 67 1/2 per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in. .. 25c ft.	15-in. .. 1.40 ft.
6-in. .. 40c ft.	18-in. .. 1.90 ft.
9-in. .. 70c ft.	20-in. .. 2.25 ft.
12-in. .. 1.00 ft.	24-in. .. 3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.

Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; 3/4-inch, \$1.45.

Burnt River rubble stone delivered, \$16 to \$17 per toise.

Plain steel bars, \$2.25.

Square twisted bars, 3/4 to 1 1/4, \$2.35.

Malleable fittings — Canadian discount, 45 and 42 1/2 per cent.

Free stone delivered, \$15 to \$18 per toise.

Brown coursing stone, delivered, \$3.75 per yard.

Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.

Sand, for cement or brick work, \$1.30 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 90c to \$1.05 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, \$1.30 per ton.

Steel channels and beams, angles and plates, \$2.65 to \$3.00 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from \$8.00 to \$8.50, bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, \$1.50 bbl.

Manilla Rope, best, per pound, 12 1/2 cents.

PAINTS AND OILS

Pure White Lead, ground in oil, \$9.50 per 100 lbs.

Boiled Linseed Oil in bbls., 58c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 55c per gallon.

Pure Red Lead, dry, \$7.00 to \$8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3 1/4c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 65c.

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Gravity System Equipment on Large Concrete Building

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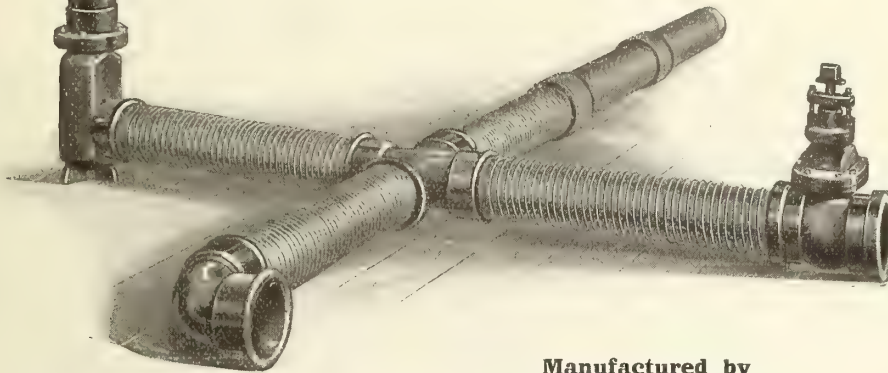
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**Galvanized Wire Wound and Continuous Stave Pipe
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We will quote you attractive prices on any of the above—write us.

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Built of the popular Hamilton Red Pressed Brick

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Estimates furnished promptly. Capacity 18,000 Tons Annually.

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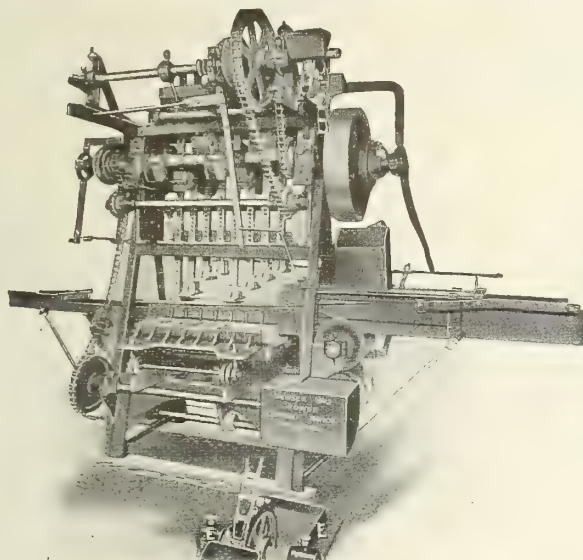
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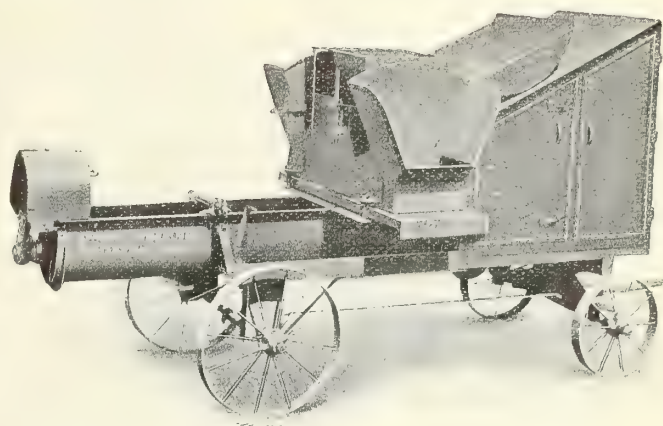
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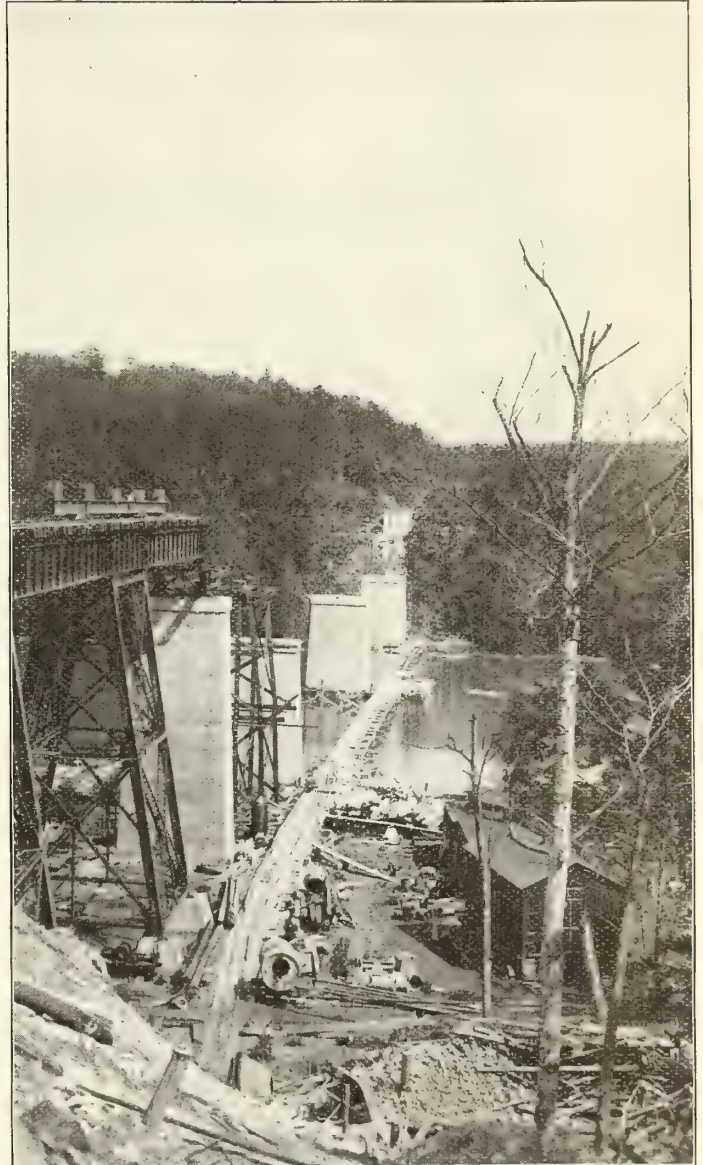
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We manufacture blocks of the highest possible standard, the very best materials only being used and in the DOMINION WOOD BLOCKS we believe we produce an article that has no equal.

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These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

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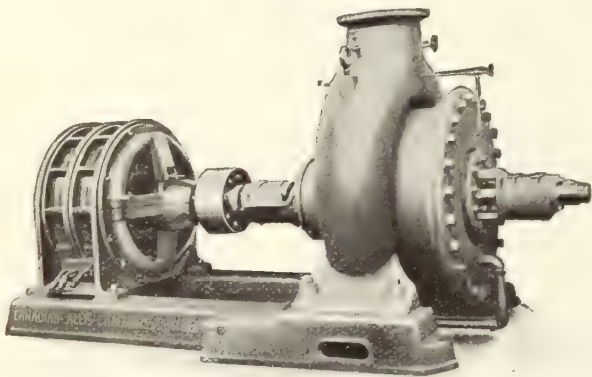
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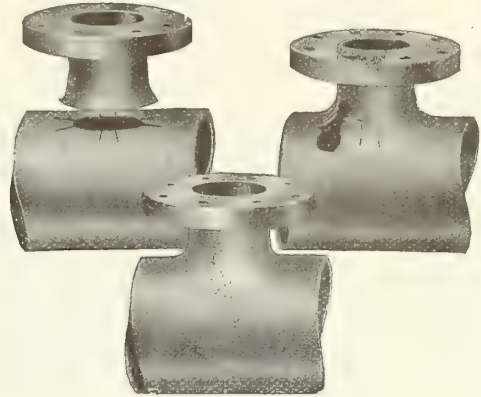
Every conceivable style and design in ornamental iron fence work can be faithfully carried out by us.

Send in your specifications and get our quotations.

We also specialize in iron stair work.

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Toronto Wire Iron and Brass Works Co., Limited
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"As Strong as the Pipe"

Interlock Welded Necks

Will eliminate two-thirds of your joint trouble. How? By eliminating two-thirds of your joints with their bolts, gaskets and liability to leak. An **Interlock Neck** is much lighter than a cast iron or steel fitting, although "as strong as the pipe."

We design and execute complete piping contracts.



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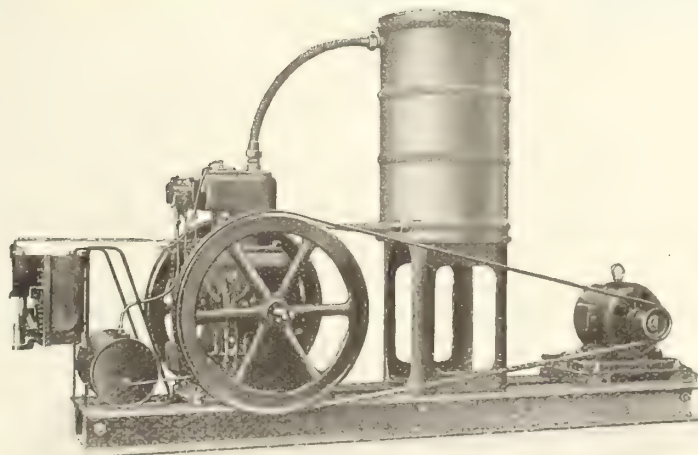
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We have Supplied

Lighting Installation to municipalities and received repeat orders from them.

Requires no skilled electrician to operate.

Cheapest and easiest plant to install on the market.

It is self-starting, self-regulating and self-stopping and generates electricity at the minimum of cost.

Any voltage or capacity.

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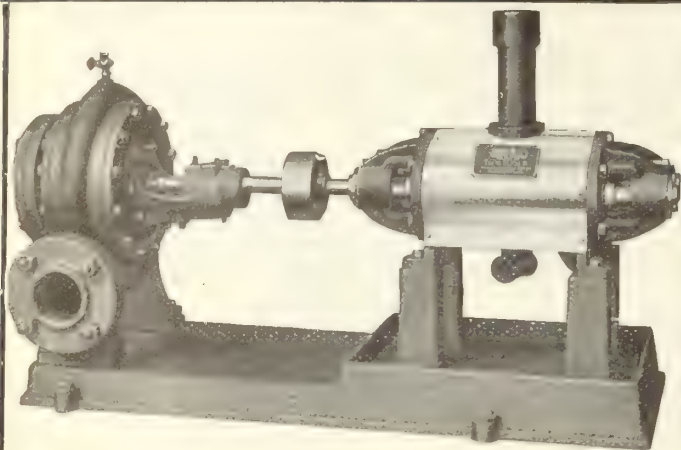
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The new factor in Pumping Cost.

The remarkable performance of the Spiro turbine as applied to centrifugal pump drive, merely proves the old truth about the cardinal virtue of simplicity.

A gas producer yields a horsepower from the smallest quantity of coal, yet a steam operated Spiro-Centrifugal pumps a gallon of water at a much smaller total cost, figuring attendance, depreciation, investment and fuel combined.

Over and above this, the Spiro-Centrifugal has set up a new standard in continuity of operation, and by its almost total absence of repair cost.

"Buffalo" SPIRO- CENTRIFUGAL PUMPS

No one dreamed that a pair of plain herring-bone gears could be made into an engine or turbine before the advent of the Spiro. This new principle is revolutionary and has reduced prime mover construction to what would seem the limit of simplicity, service and economy combined. Not a single blade, nozzle or valve in the entire unit. Just a pair of herring-bone gears enclosed in a cylinder, with a jet of steam blown against them.

Ask for new 84-page catalog No. 225, and investigate the wonderful adaptability of the Spiro for direct connection to Pumps, Fans, Generators and machinery used in mining, quarrying and other pursuits.

Buffalo Steam Pump Co.

Sole Canadian Agents—

CANADIAN BUFFALO FORGE CO.

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Protect Your Buildings As Well as Insure Them !

Prevention of fires is vastly better than the partial redress which is all the best Fire Insurance Policy can give you. This prevention is easily secured by using

Asbestocement Building Materials



make roofs that are handsome, *fireproof*, practically everlasting and moderate in price.

Linabestos Building Board

prevents inside fires from spreading. It is quickly applied, and gives a permanent, attractive, yet inexpensive interior finish.

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makes walls and roofs for Garages, Stables, Barns, Warehouses and Factories that are absolutely *weather and fire proof*.

**You build for all time when
you build in Asbestocement.**

Write for Booklet **C. R.** and state in which products you are particularly interested.

Asbestos Mfg. Co., Limited

Address—E. T. Bank Bldg., 263 St. James St.
MONTREAL

Factory at Lachine, P.Q. (near Montreal)



13 Questions For the Contractor To Answer

If as a contractor you are not using motor trucks, ask yourself the following questions and answer them honestly:—

1. How many horses have you?
2. How much money have you invested?
3. How much does it cost per day to operate your teams?
 - (a) Including interest on total investment for horses, trucks, harness and other equipment?
 - (b) Stable charges?
 - (c) Drivers, etc.?
4. What is the life of a horse?
5. Do you figure depreciation on this basis?
6. How many cubic yards or tons can you haul per day?
7. Are you willing to be convinced that motor trucks can do this amount of work at a lower cost?
8. Can you improve your loading and unloading facilities to reduce time lost in this way?



The Perry Sand Co., of Buffalo, using Mack Trucks

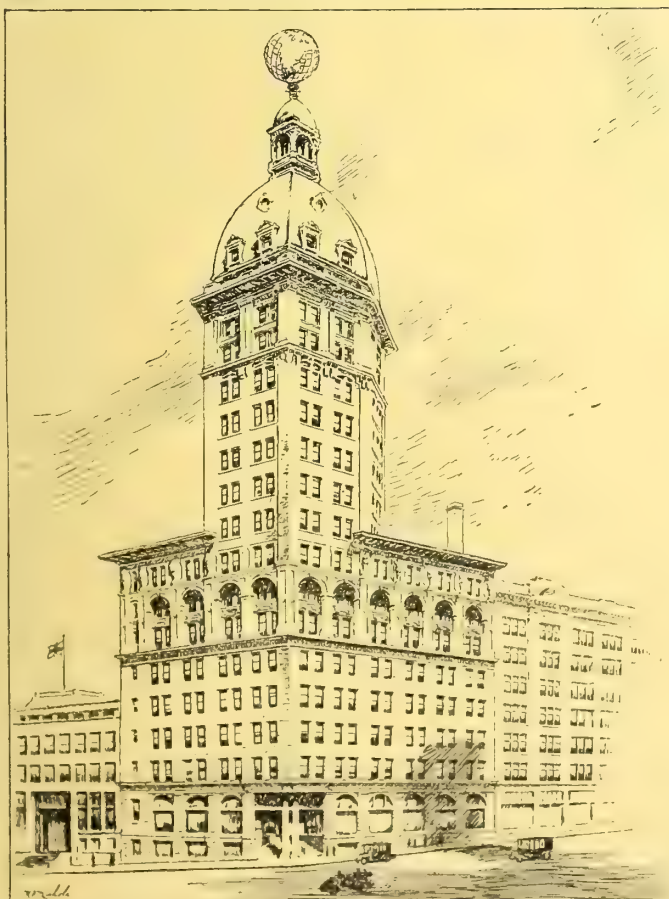
9. What is your average length of haul?
10. How many trips can you make with horse trucks?
11. Do you know that a single automobile truck is doing the work of four horse teams in your business?
12. Is there any reason why the automobile truck cannot do as much for you?
13. Isn't it worth your while to investigate this situation?

Ask us about the "MACK"

The Canadian Fairbanks-Morse Co., Limited

St. John, N.B. Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver

8



Across Canada with the Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Seventh of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire and Cable Co's. Limited, wires.

This picture shows the

World Building, Vancouver

This building was wired with

"Adanac" Rubber Insulated Wire

Architect: W. T. Whiteway, Vancouver.

Engineer: W. E. Hughes, Vancouver.

Electrical Contractor: J. G. Sutton, San Francisco, Cal.

Address enquiries to nearest office

MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Ltd., Calgary and Vancouver.

"ADANAC" "IMPERIAL HIGRADE" and "30% PARA"



Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

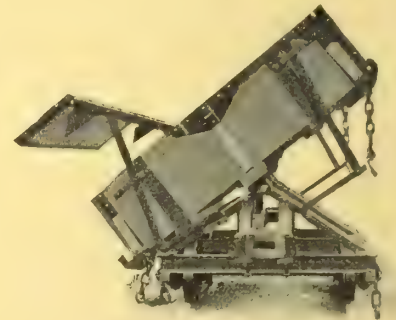
Brickyards, Quarries,
Mines, Contractors, etc.

All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

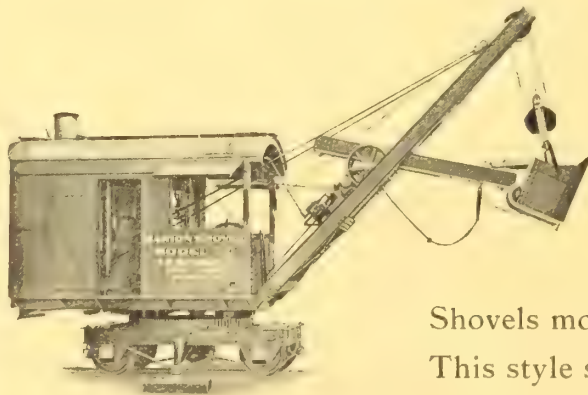
We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.



“MARION” STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
5 8 - 1 and 1 1/2 cu. yd. capacity



Shovels mounted on Traction Wheels or Railroad Trucks.
This style shovel is specially adapted for Brickyards—Mines
—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

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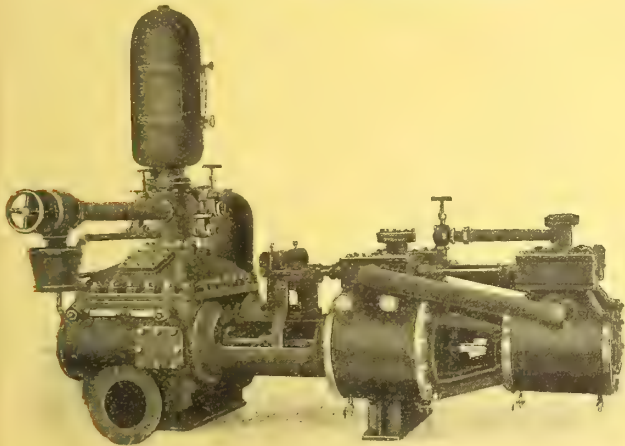
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"A FRIEND IN NEED"

A Smart-Turner specially designed Fire Pump
you will find to be a friend indeed.



The SMART-TURNER MACHINE CO., Limited
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Bent Glass

Made in all
Kinds of
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on Short
Notice

Large Bent Plate Glass for Shop
Fronts a Specialty

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have gained their reputation for

Simplicity of Design
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for city and town Water Systems,
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One-half the cost of Iron Pipe—
and better.

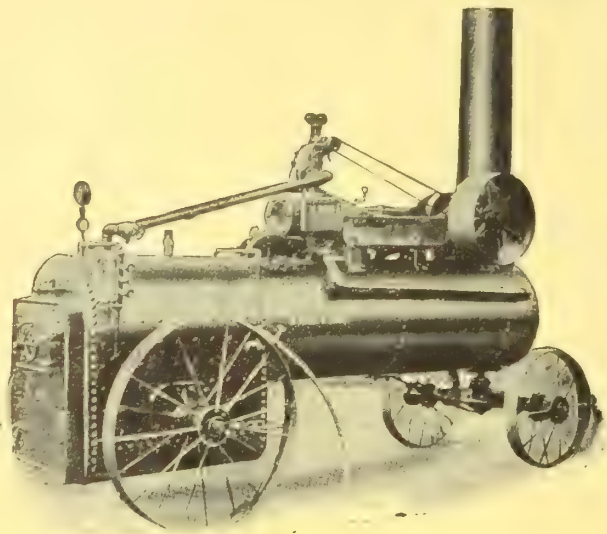
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Portable Power Plants

The cut shows one of our compact and *portable* power plants for driving Crusher Outfits, etc. A complete power plant in itself—durable and efficient. We build different sizes and can meet your requirements precisely.

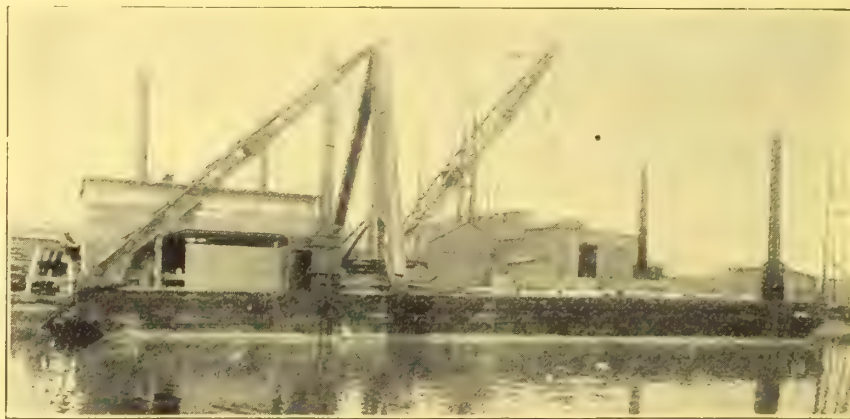
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We also build Boilers, Air Compressors, Engines, Derrick Engines, Hoists of all kinds, Crushers, Screens, etc.

Any of our offices will gladly furnish catalogs and particulars.

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Here Is One of The Most Powerful Steel Barge Derricks Ever Built

It's an "AMERICAN," of course.
50 tons is its nominal capacity.

This great barge derrick was built for the G. H. Starke Dredge and Dock Co., of Milwaukee, and is a convincing testimonial to the skill of our engineers and the efficiency of our shops.

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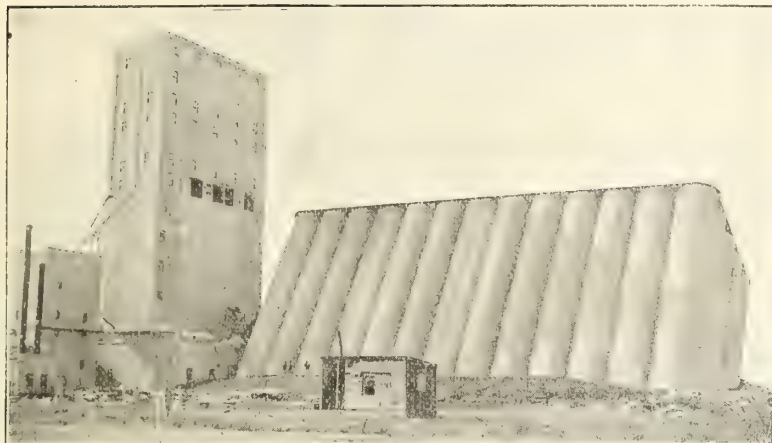
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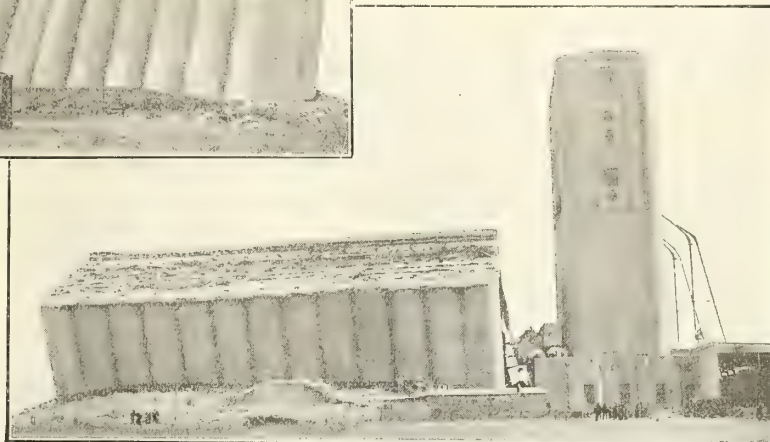
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Concrete Withstands The Severest Tests—

In the San Francisco earthquake and the Ohio floods, concrete structures withstood the terrific tests of fire, water and vibration without damage.

Now, right in our very midst, comes a striking illustration of concrete's enormous power of resistance and durability.

This great concrete structure, built only to resist the pressure of grain from the inside, while filled almost to capacity with 55,000,000 pounds, or 27,500 tons of grain, settled to an angle of 30 degrees from its original perpendicular position.

In the settling, the walls were subjected not only to the terrific twisting strain of their own weight, but to the weight of thousands of tons of grain as well.

Contract for the restoration of this enormous structure has been awarded to Barnett & McQueen, and it is anticipated that it will be put back into its original position without the slightest injury.

No Loss of Contents

Think of the irreparable loss, had this elevator been built of some destructible material—a material that would have collapsed almost as soon as the settling commenced, and which would have entailed not only the loss of the building, but almost a total loss of its contents.

We have published a number of books which contain the most complete information and beautiful illustrations of almost every use of Concrete (Building, Roads and Pavements) for the architect, engineer, contractor, business-man, manufacturer and everyone interested in a material of such permanence and economy.

These books are free and you may have a copy for the asking—simply state what subject you are interested in, on a post card, and send to

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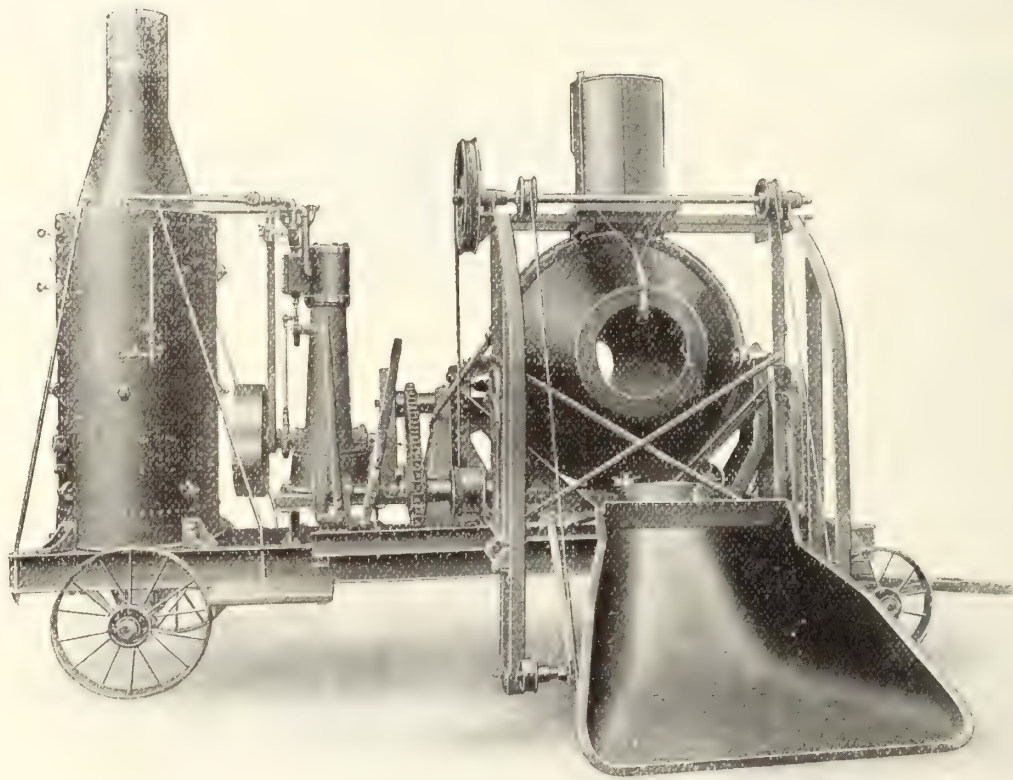
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RESOLVE

that your plant shall include all up-to-date and profit making equipment.

Smith Concrete Mixers



Standard Smith Mixer on Trucks with Boiler, Engine and Side Loader

Are up-to-date. They are made of the best materials—eliminating repairs and will save you money.

Catalogue No. 45 Sent on Request

Mussens Limited

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COBALT, Opp. Right of Way Mine

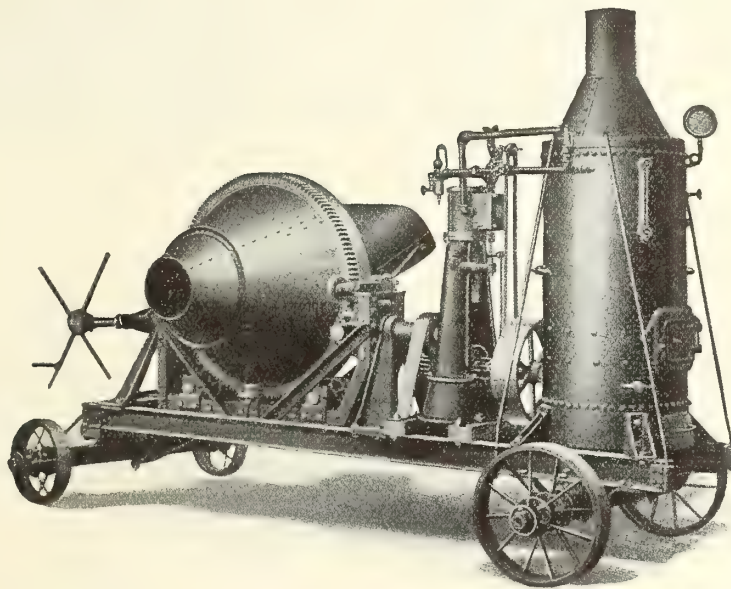
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The Mixer For You

Smith Concrete Mixers

are scientifically built, they dump scientifically
and have few wearing points.



Standard Smith Mixer on Trucks
with Boiler and Engine

The mixed material produced is best in quality and quantity.

SMITH MIXERS NEVER FAIL

Carried in Stock

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(Continued on page 12)



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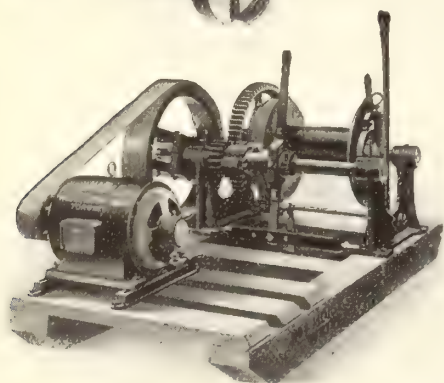
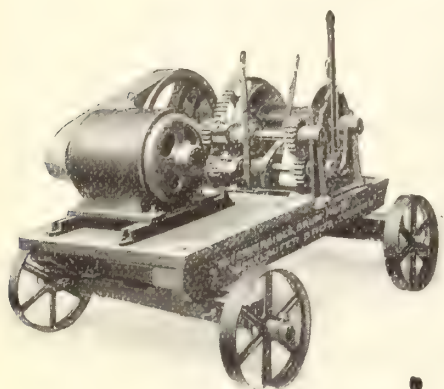
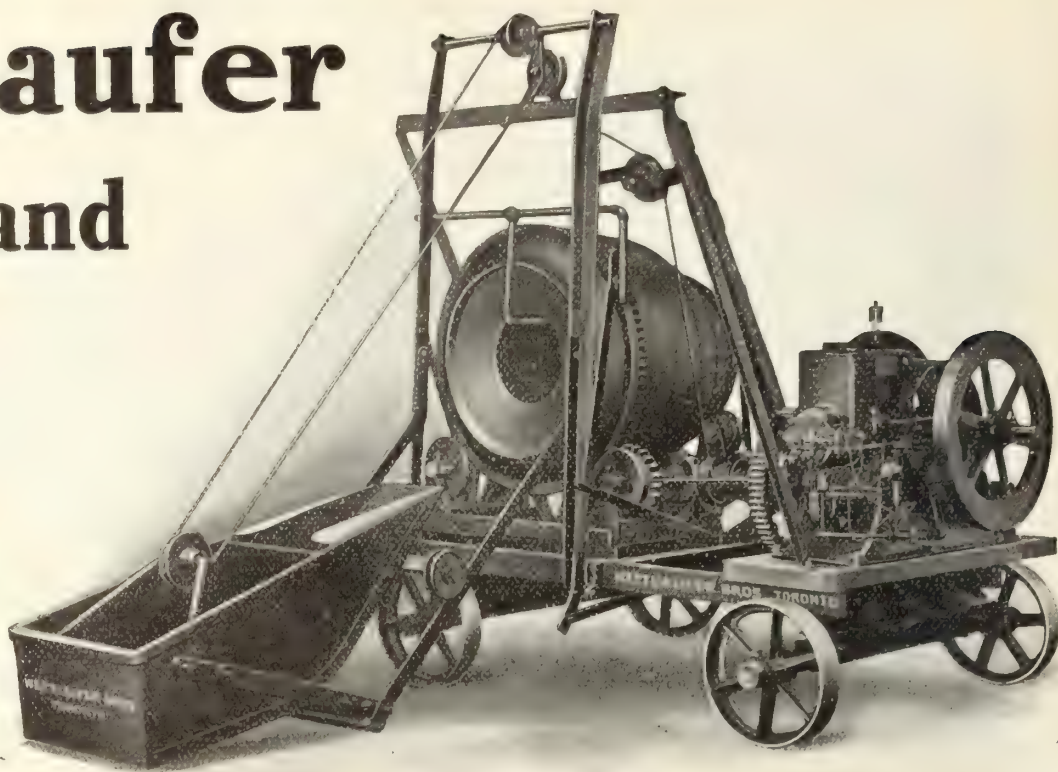
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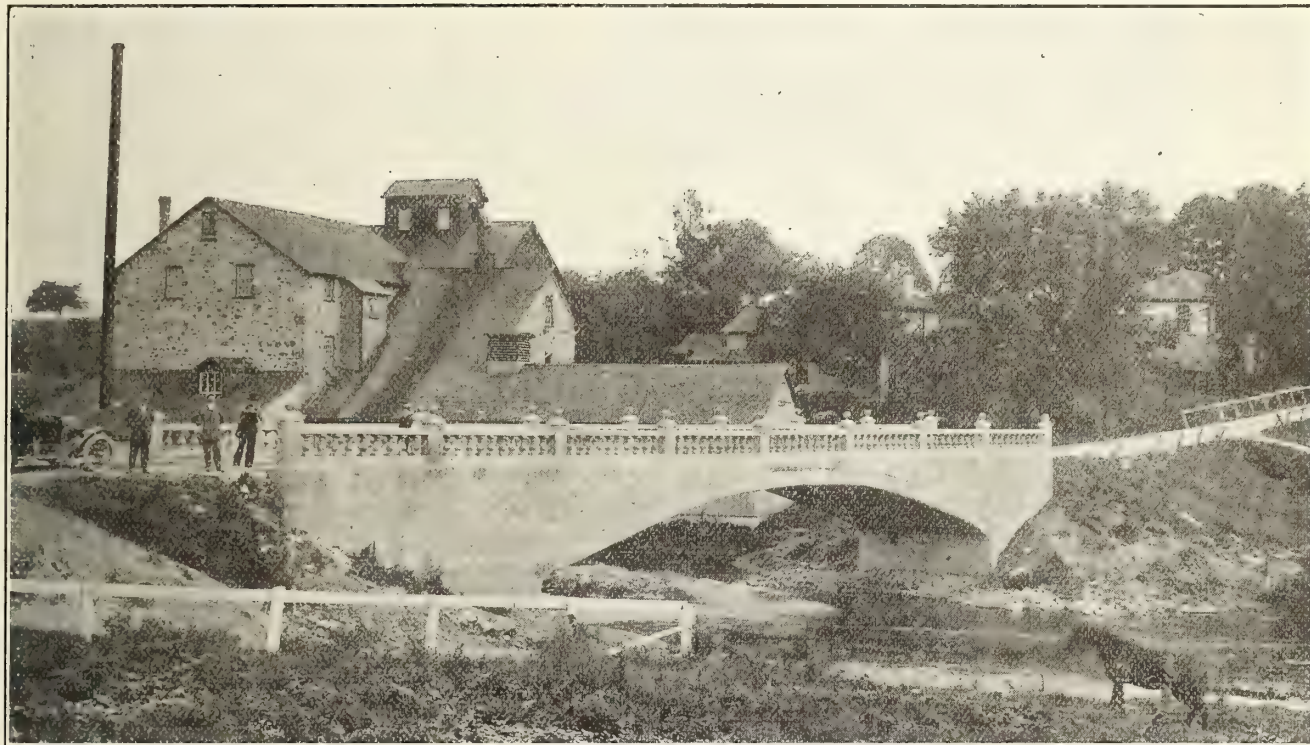
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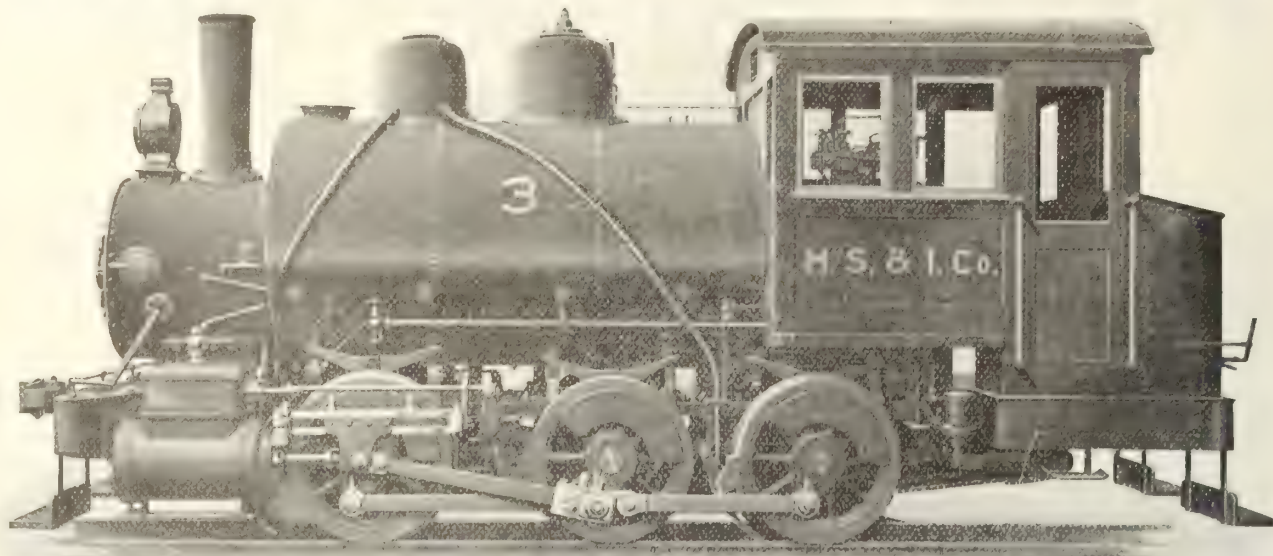
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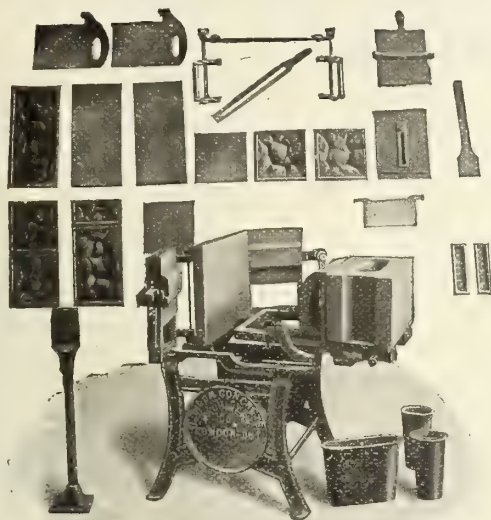
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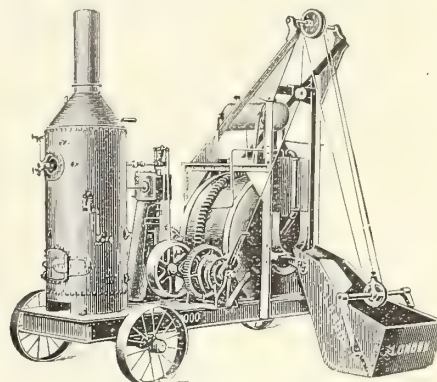
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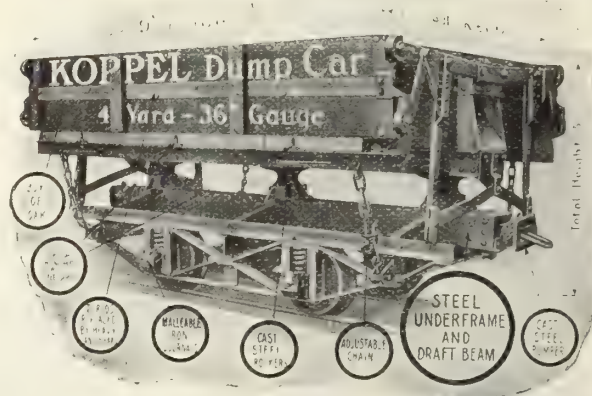
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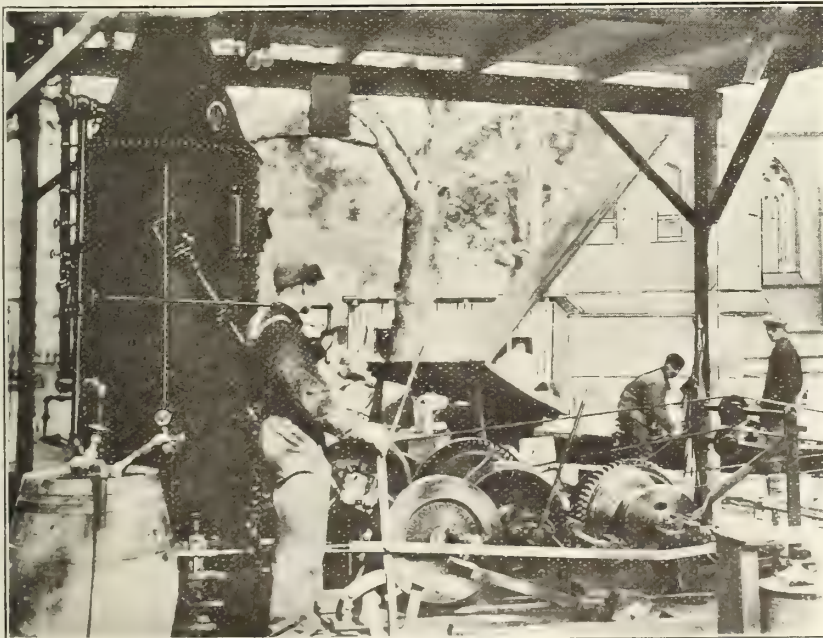
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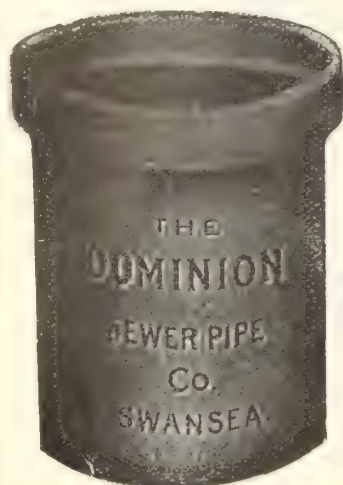
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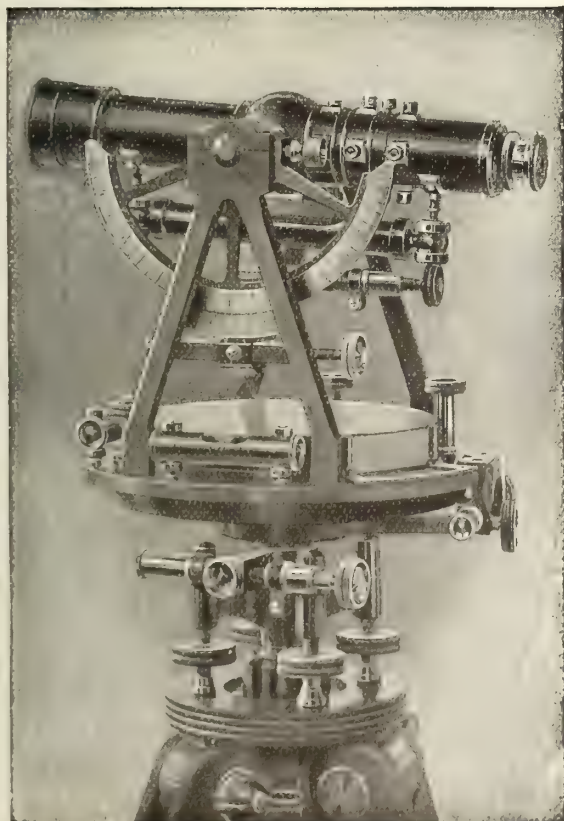
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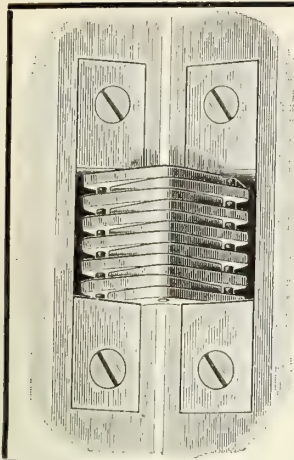
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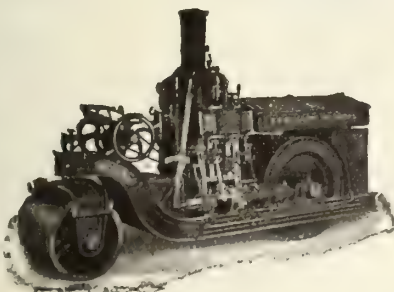
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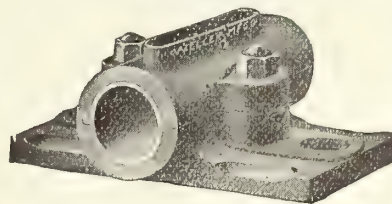
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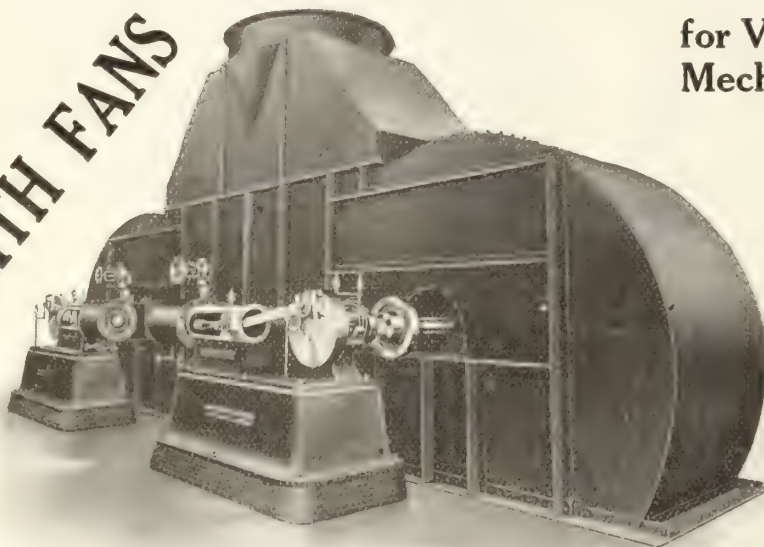
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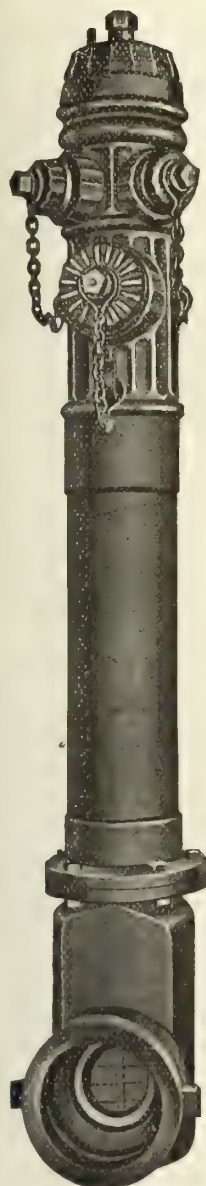
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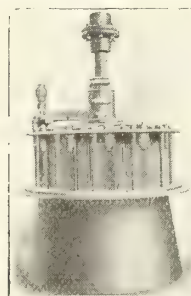


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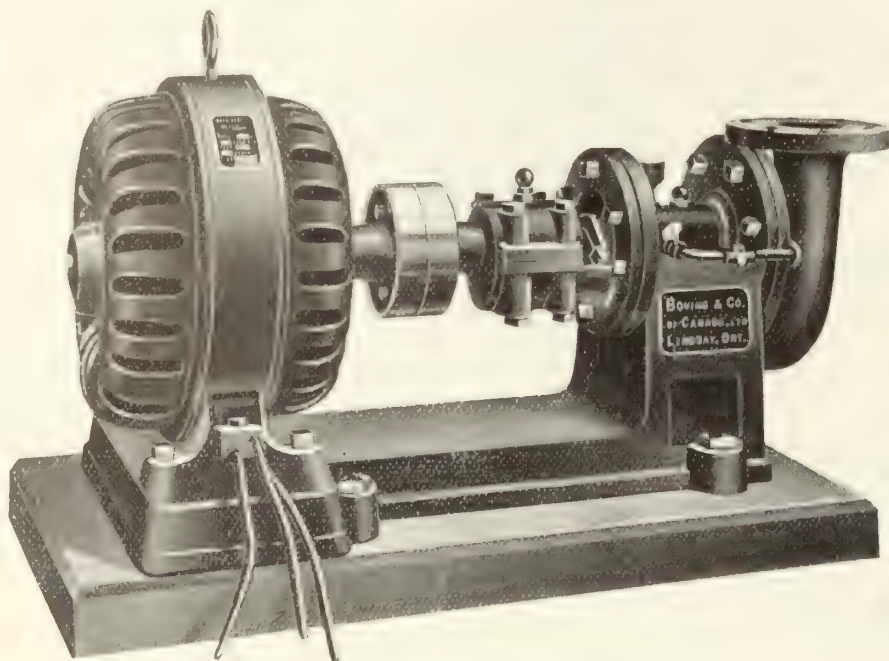
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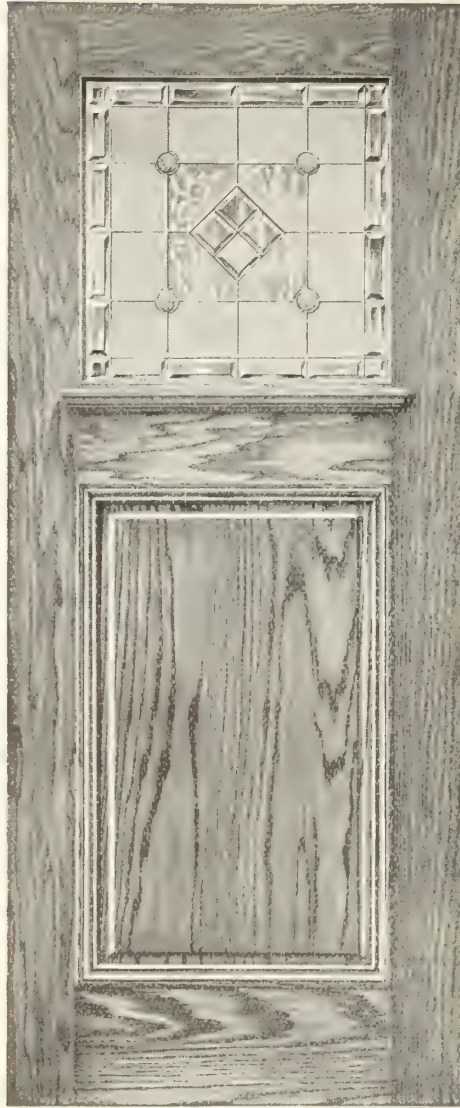
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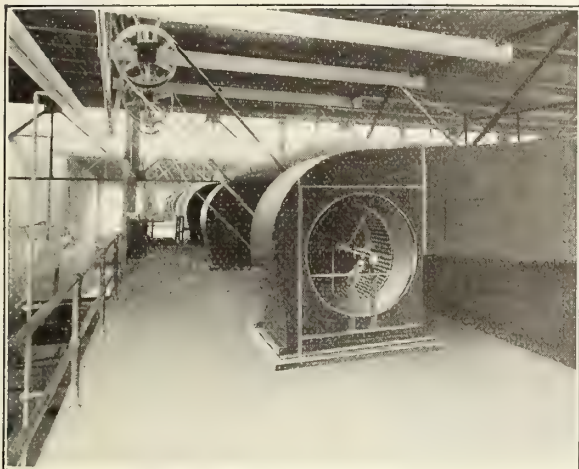


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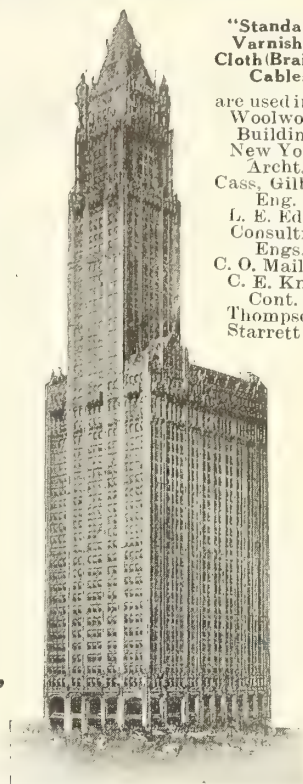
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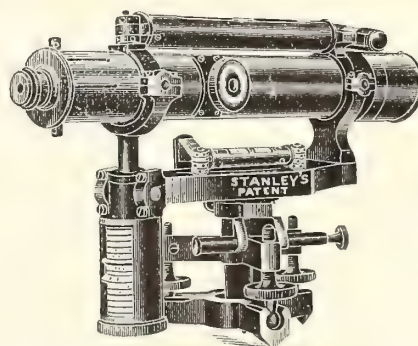
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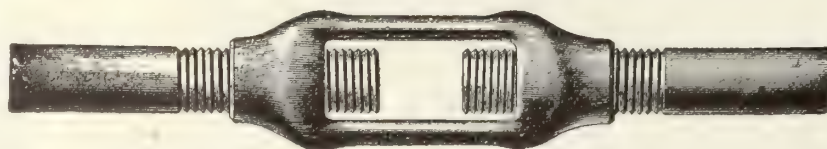
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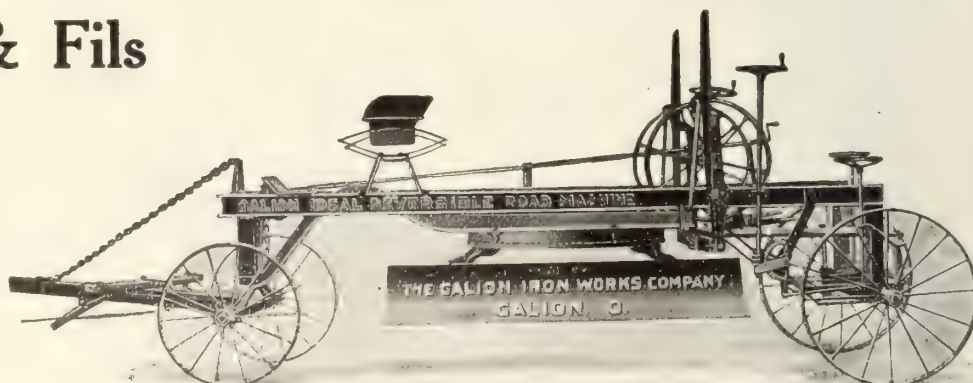
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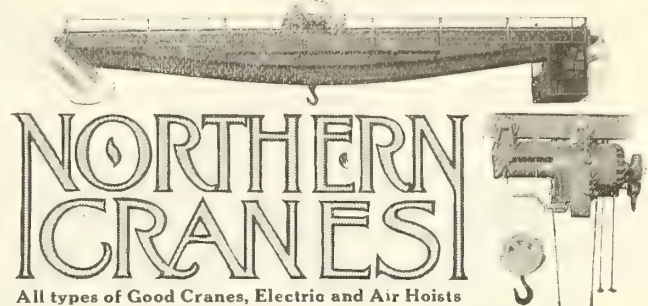


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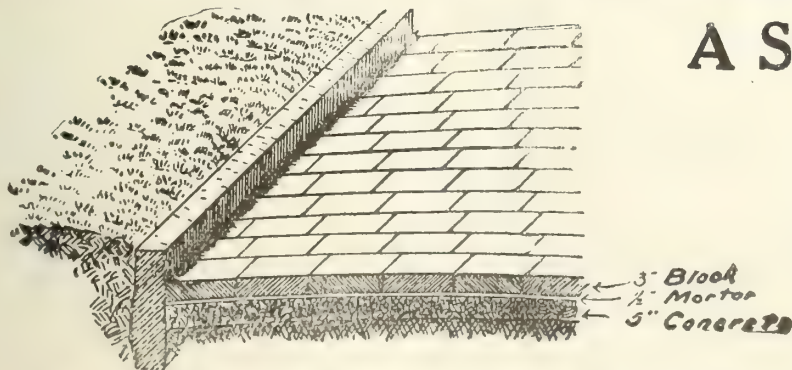
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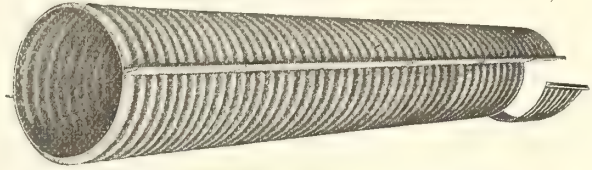
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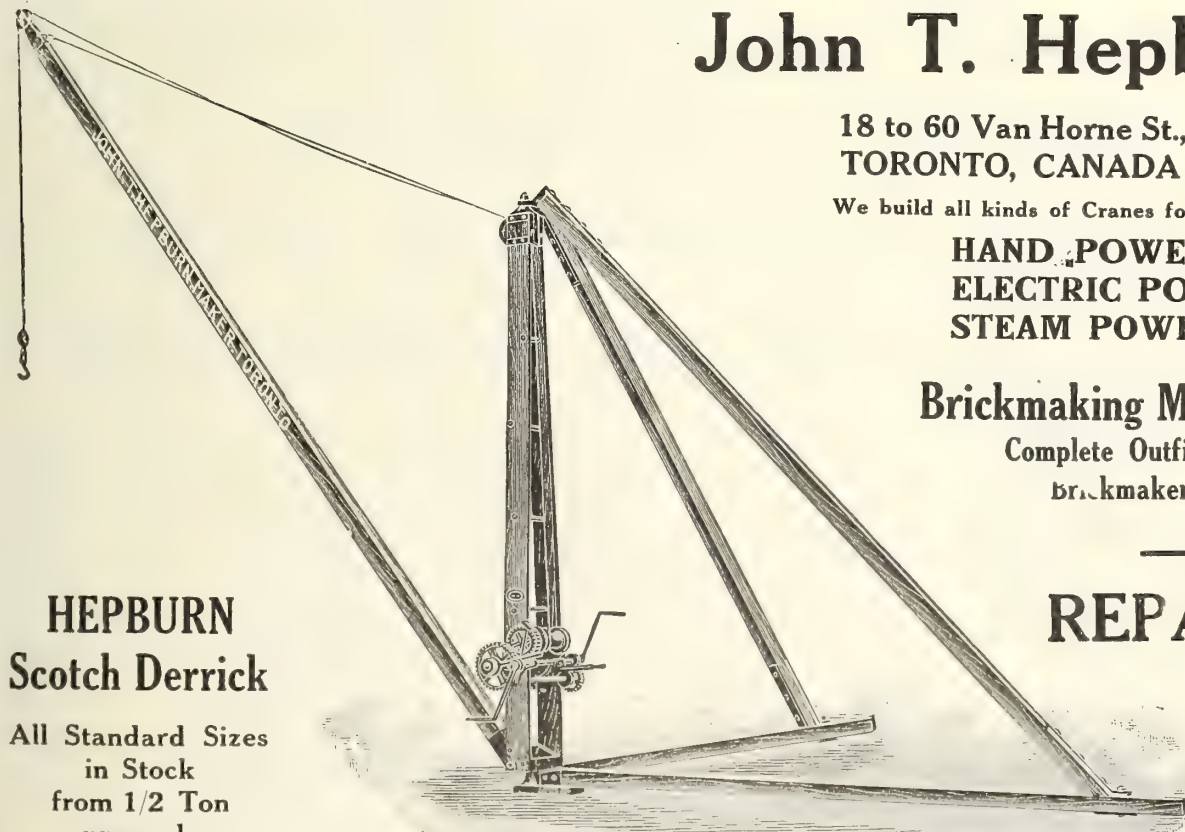
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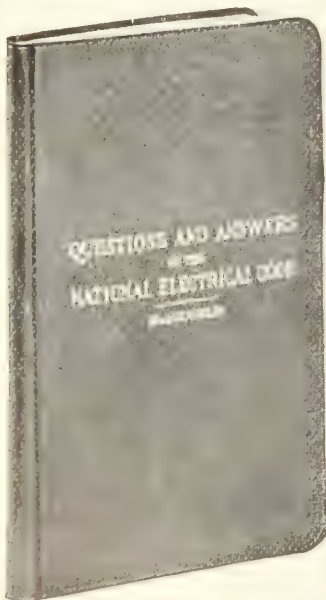
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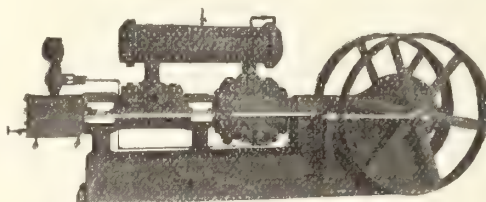
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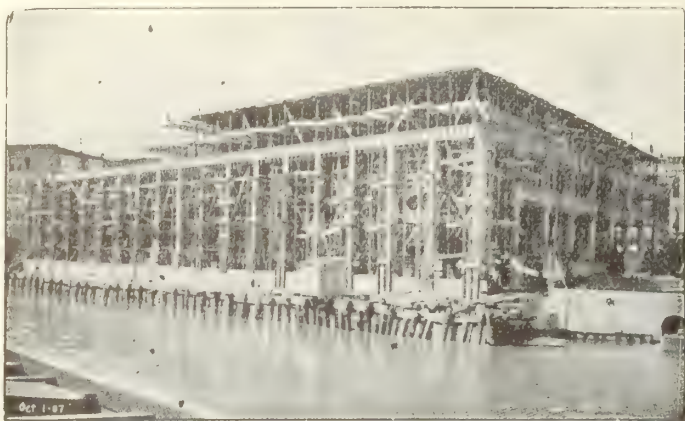
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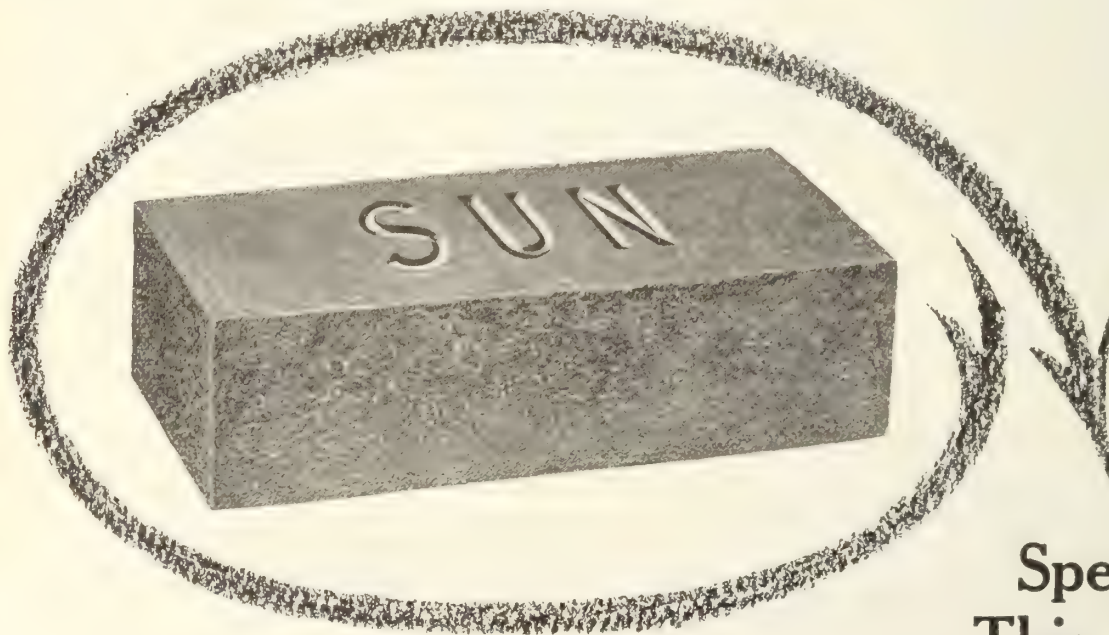
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Contract Record

ESTABLISHED 1886

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January 14, 1914

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The first part of a copious extract of an interesting treatise prepared for the Western Society of Engineers. The complementary portion will appear in the Contract Record for January 21. The subject, despite the title, is discussed in such a way as to appeal particularly to those of practical rather than of aesthetic temperament, constructional methods and the use of material being emphasized throughout. The article in its entirety is illustrated by fifty half-tone illustrations.	
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The Toronto Filtration Plant

ELSEWHERE in this issue Mr. Allen Hazen, the well-known consulting engineer of New York, makes a spirited defence of the efficiency of the Toronto filtration plant from the standpoint of design, construction and operation. The letter contributed by Mr. Hazen should not be allowed to pass unnoticed and unanswered, for whatever differences of opinion there may be it is certain that the author of the letter is desirous of making a straightforward explanation illustrated by only such purely technical data as are required to make his points. The letter is addressed to the Editor of the Contract Record, but it concerns every public-minded Toronto citizen in general and everyone identified with municipal engineering design and construction in particular.

Some of Mr. Hazen's observations appeal to us very strongly. Particular stress must be laid upon the limited sum placed at the disposal of the engineers. It is like measuring a rapidly-growing boy for a skin-tight suit. By the time he gets it, it is useless. The development of Toronto has gone on by leaps and bounds during the last few years and we are inclined to think that it is the city, not Mr. Hazen, that is to blame for the installation of a plant half the size required for immediate expansion. Mr. Hazen is surely right in assuming that no filtration plant ever provoked greater criticism. This, taken in conjunction with what Mr. Hazen shows in his table, namely, that the Toronto plant is the cheapest—in regard to its capacity—ever built, would seem to suggest an illuminating discussion.

In our last issue the increased consumption of water following filtration was the subject of an article based upon the experience of Toronto, whose consumption of water increased between the years 1908 and 1912 from 30,00,000 to 44,700,000 Imperial gallons. A careful reading of that article in conjunction with the material published in this issue may be found instructive.

Engineering Responsibilities and Lay Administration

MONTREAL'S unfortunate experience with its conduit, a break in which deprived the city of its water supply for a whole week, brings up the question of whether such things are not the direct result of the administration of the city's affairs by politicians who are hampered by having their own and other individual ends to serve. This is an issue worthy of close concentration—an issue which pops up whenever a municipality makes a mess of things. The worst of it is that, collectively, we seem quite unable to learn a single lesson. Every now and then we wax indignant about some atrocious blunder on the part of a municipality, but in the end things simmer down, the man in the street forgets the sensation and the private interest inside the local corporation prevails.

In defence of the governing authorities at Montreal it is held that they were responsible only in an indirect sense, that is to say, because they placed the seal of approval upon an incomplete plan and allowed the engineering department to proceed without building an emergency conduit. But the day has passed when responsibility can be evaded on such grounds.

We contend that a system which gives final authority in engineering matters to ill-informed politicians

is fundamentally wrong. Constituted as things are at present, the engineer of a municipality is only a servant taking instructions. He may lack in ability and experience, but that is not the issue: his competency, or incompetency, is the concern of those who retain his services. On the face of it, it would appear to be lacking in balance to retain a man alleged to be incompetent for a number of years and suddenly discover that he is not "big enough" for the position. Had he been "big enough" for the appointment in the first place he would have developed with the municipality and none better than he would have been qualified to plan for its future growth. Before generalizing further, however, it may be of interest to enter into a few details about the collapse of the conduit.*

Revealed by an investigation made by Professor Brown, of McGill University, the state of affairs at Montreal was deplorable. Professor Brown states that the aqueduct, which is now being considerably widened, had been enlarged until the sides were so close to the conduit that, on one side, only a few feet of loose earth supported the structure. In addition, the aqueduct had been excavated to a depth of several feet below the bottom of the conduit. It was intended that the conduit should be imbedded in earth, providing it with lateral supports on both sides. On one side, however, this support had been practically removed several hundred feet, while the foundations were in danger of being undermined by the deepening of the aqueduct. The conduit was subjected to forces which had not been reckoned with and cracks developed on the aqueduct side. After some ineffective patchwork had been attempted, a fissure, sixty feet long, developed, and a large portion of the side broke away, causing the complete stoppage of the city's pumps. Professor Brown criticises severely the methods employed in the repair of the conduit, the inefficiency of which was responsible for much needless delay. Finally he affirms that cracks are still likely to occur in several hundred feet of the conduit upon which the greater portion of Montreal depends for its water supply. Professor Brown's observations are confirmed in the main by Mr. Phelps Johnson, vice-president and general manager of the Dominion Bridge Company, and ruling president of the Canadian Society of Civil Engineers, who, however, adds that the repairs have been carried out expeditiously and capably and are permanent.

Particularly in relation to engineering works the present system of election and subsequent administration is a most lamentable one. In Montreal, Toronto and other large cities throughout the Dominion, we are carrying through constructional works the execution of which calls for great business acumen and technical skill; and yet, with an expenditure of millions involved, a very considerable part of the administrative end is relegated to men of remote origin whose principal asset, nine times out of ten, is an inflated idea of their own worth.

Is it not time that we took warning from such developments as those at Montreal and considered the need for a thorough investigation of our system of govern-

ment? So-called official enquiries into local blunders are all very well in season, but why not an investigation higher up? Why is it that the candidates for our municipal offices are drawn from the tag-rag of the business world? How is it that it is impossible to induce the substantial men of the community to run for office? How many men who are taking an active part in the administration of our affairs—at Montreal and Toronto, for instance—are capable on the ground of technical or business training, general information—and even elementary education, of taking any intelligent, constructive part in the discussion of an important engineering enterprise?

We believe that all these questions could be answered and solved by a centralized administration—government by a few competent men demanding the highest salaries paid in any field. In Montreal it has been suggested that the control of engineering, financial, industrial and commercial undertakings be handled by a body of, say, three men, appointed for at least six years, retiring in rotation and receiving a salary of not less than \$20,000 a year. We are inclined strongly in favor of this suggestion, feeling confident that had such a plan been put into effect in recent years it would have meant a saving of hundreds of thousands of dollars in both Montreal and Toronto. Of course there are objections to government by commission, but we fail to see how these could be sustained in face of the hopeless muddle in just one department—water supply—for which the present system has been responsible at the above cities, and at Ottawa in addition. To our mind the most difficult thing is to find men worth the large salaries suggested. If they were not available in our own country it might be undesirable to have the control of the greater part of our important municipal affairs in alien hands. But in any case it would appear timely to inaugurate a public movement with a view to educating the community to an appreciation of its responsibility in the matter of maintaining and supporting the present system.

From the information at hand it is possible to arrive at no other conclusion than that there has been either gross neglect or out-and-out incompetency at Montreal. In the interest of both municipal engineering and municipal administration it is to be hoped that the apathy of the man in the street, which is usually in evidence within a month of such an occurrence, will not find its way into the promised investigation, the outcome of which will be awaited with interest.

Fighting oil fires with sawdust was discussed at a meeting of the American Society of Mechanical Engineers by Mr. Edward A. Barrier. The efficiency of the sawdust, he said, was undoubtedly due to its blanketing action in floating upon the surface of the liquid and thus excluding the oxygen of the air. Its efficiency was greater on viscous liquids than on thin liquids. Sawdust itself was not easily ignited and when it did become ignited it burned without flame and the burning embers did not have sufficiently high temperature to reignite the liquid. It was found that the addition of sodium bicarbonate greatly increased the efficiency of sawdust, as shown both by the short time and by the decreased amount of material necessary to extinguish fires. A further advantage of the addition of bicarbonate of soda was that it decreased the possible danger resulting from the presence of sawdust in manufacturing plants.

*The conduit is 9 x 7½ ft., of horseshoe shape, laid on a grade of about 1:5000, with crown 4 to 5 ft. below ground surface. It carries water under a slight head (hydraulic grade 5 to 10 ft. above top of pipe). It was designed in the office of the Water Department and was built by Patrick McGovern, of Boston, Mass. Its section may be described as follows: Invert: Radius, 13 ft.; thickness, 8 in. Sides and arch: Inner face a part-circle of 4½-ft. radius, and so placed as to give a clear height of crown above invert 7 ft. 8½ in.; outer face, such as to give thickness at crown 8 in., thickness at base of sides 8 in., and thickness on horizontal centre about 12 in. Reinforcement: Clinton wire mesh.

LETTERS

The Toronto Filtration Plant

New York, Jan. 7, 1914.

Editor Contract Record:

It is now two years since the filter plant on Toronto Island was put into service. Probably no water purification plant ever built has been subject to a greater amount of criticism. For the most part this criticism has been unjust and unwarranted. The plant was designed by our firm under Mr. C. H. Rust, then City Engineer, and Mr. Longley, now one of our partners, acted as Resident Engineer for its construction. As the city is now proposing to build another plant of different character, against our advice, after we had been engaged to design an extension of the present plant, a brief statement in regard to the old plant—what it is, what it is capable of doing, and what it has cost—may be in order.

The Plant a Substantial and Ample One

The construction throughout is simple and substantial. Concrete masonry in arches designed to be in compression throughout forms most of the structure. All the piping and auxiliaries are of ample capacity to serve the intended rate of output, and are also sufficient to carry a fair percentage of overload. These matters are all described in a paper presented recently by Mr. F. F. Longley to the Canadian Society of Civil Engineers and printed in their transactions.

The main part of the work was constructed under contract by the firm of Dill, Russel & Chambers. The pipe and specials were furnished by the Canada Foundry Company; gates, by the Ludlow Valve Company and the Coffin Valve Company, while pumps and other equipment were furnished by the John Inglis Company and the Allis-Chalmers Company. All of the work was performed in a workman-like manner under close inspection. It compares favorably with corresponding work in any plant and reflects credit on the several contractors.

The Capacity of the Plant

There is some misapprehension as to the capacity of the plant. In a water-works pumping station, as a general rule pumps must be at hand with a capacity twice as great as the average daily output. There are two reasons for this. One

is that the rate of output fluctuates and that the pumps must operate at times at a higher rate than the average; the other is that pumps must be put out of service for overhauling and repair from time to time, and the station must be capable of yielding full service with one or more units idle. The same is true of all kinds of water-works equipment but in varying degrees.

With filters it is a common rule that the capacity of the plant must be 50 per cent. greater than the average daily output. This rule applies equally to sand and mechanical filters. A filter is a more reliable piece of apparatus than a pump and the filtering capacity does not have to be as great as the pumping capacity to insure reasonable safety.

The present plant was designed to have a nominal capacity of 48 million gallons a day, suitable at the above-mentioned ratio for an average daily output of 32 million gallons a day. It was designed when the average rate of output was 28 million gallons a day, and was increasing but slowly. The rapid growth of the city, and the still more rapid increase in the amount of water required per capita after the plant was started brought the consumption above its intended capacity before it was put into service. It is passing a daily average of nearly 40 million gallons of water at the present time. It would be possible to force it to pass a larger quantity but at some sacrifice in quality. On the other hand, if no more water was demanded from it than the amount for which it was designed, the average quality of the output at the present time would be appreciably improved. The remainder of the present supply is not filtered but is disinfected before use.

Plant an Economical One in First Cost

The appropriation under which the plant was built was limited. The sum of \$750,000 was provided to build a 40-million-gallon plant. Instructions were given that the cost must be kept within the appropriation. As this size would clearly have been too small, an effort was made to design a larger plant that could be built within the estimate. Actually a 48-million-gallon plant was built at a cost slightly above the appropriation. Thanks to favorable natural conditions the Toronto plant is the cheapest plant for its capacity of any large plant ever built.

In the following table are given for a number of large plants the approximate cost and capacities and costs per million gallons of daily capacity. These figures include engineering and contingencies and all necessary auxiliary structures, but do not include land. The capacities and costs per unit are given both in U. S. and Imperial gallons. The unfortunate difference in size of the gallon in the United States and

COST OF RECENT LARGE WATER PURIFICATION PLANTS.

Plant	Kind	Approx. Cost including Engineering and Con- tingencies but exclud- ing land	Nominal Capacity		Cost per Million U. S. Gallons Daily Capacity	Cost per Million Imperial Gallons Daily Capacity
			Millions of U. S. Gallons per day	Millions of Imperial Gallons per day		
Toronto	Sand	\$757,000	57.5	48.0	\$13,200	\$15,800
Minneapolis	Mechanical	616,000	39.0	32.5	15,800	19,000
Watertown	Mechanical	100,000	6.0	5.0	16,700	20,000
East Jersey	Mechanical	540,000	32.0	26.6	16,900	20,200
Grand Rapids	Mechanical	350,000	20.0	16.7	17,500	21,000
Columbus	Mechanical	615,000	30.0	25.0	20,500	24,500
Harrisburg	Mechanical	317,000	14.0	11.6	22,600	27,200
Springfield	Sand	343,000	15.0	12.5	22,900	27,500
Toledo	Mechanical	522,000	20.0	16.7	26,100	31,400
Kansas City, Kan.	Mechanical	175,000	6.25	5.2	28,000	33,500
Cincinnati	Mechanical	3,344,000	112.0	93.0	30,000	36,000
Albany	Sand	500,000	16.0	13.3	31,300	37,500
Washington	Sand	2,736,000	81.0	67.5	33,800	40,500
New Orleans	Mechanical	1,354,000	40.0	33.3	34,000	40,500

in Canada has been the source of much confusion. The difference is great enough so that it must be taken into account, and failure to do this has led to some misunderstanding in the past.

Accurate cost data for the sand filter plants at Philadelphia and Pittsburgh, and for the mechanical filter plant at Louisville, are not at hand. None of these costs was particularly low, and if the figures were available they would not be found at the low end of the table. Large water purification plants in Europe have usually cost more per unit of capacity than American plants.

Any comparison like that made in the table is at best incomplete because local conditions of many kinds cannot be adequately taken into account in a short table.

The fact stands out that the present sand filter plant at Toronto has cost less than any plant of its size that has ever been built. It has not only cost less than other sand filter plants, but it has also cost less than any mechanical filter plant of corresponding capacity. This is due primarily to the favorable local conditions existing upon the Island for the construction of sand filters. It would not be possible to build a corresponding plant of adequate service at the same price under less favorable conditions.

Plant Economical in Operation

An estimate was made of the probable cost of operating the sand filters before the plant was put in service. This amounted to \$1.83 per million Imperial gallons (\$1.52 per million U. S. gallons). This is exclusive of the cost of low lift pumping. Experience with the plant during the past two years has shown that this estimate was ample, the actual cost being somewhat below this figure.

In comparison with this the corresponding estimate of cost of operating a mechanical filter plant, exclusive of low lift pumping, is \$4.80 per million Imperial gallons (\$4 per million U. S. gallons). The sand filters are cheaper to operate at by \$3 per million Imperial gallons. Assuming that the plant is operated at an average of two-thirds of its rated capacity year in and year out (the present plant has been doing much more than this) the saving in operating expenses amounts to \$96 per day, \$35,000 per annum, equal to 5 per cent. interest on an investment of \$700,000. This amount is nearly equal to the first cost of the present plant. It follows that the whole cost of filtering would be no greater with sand filters than with mechanical, even though the first cost of the sand plant were nearly doubled. In other words, a reserve area of 100 per cent. could be provided, or a corresponding investment made in settling basins and other works for preliminary treatment, if that were needed, and still the filtered water could be delivered as cheaply as it could be done by means of mechanical filters.

Effect of Turbidity

It has been alleged that sand filters are unreliable for filtering lake water because at times of storms the lake water is stirred up and the water applied to the filters becomes turbid or muddy. This condition tends to increase the difficulty of conducting the operation of purification. This is true of any kind of plant that could be used. One of the reasons why it is possible to filter Lake Ontario water so cheaply is because the water, as a rule, is not subject to much turbidity. During the two years that the plant has been in service, turbid water has been experienced. At times the turbidity has been greater than shown by any record of preceding years. Much of the time, also, the rates of filtration have been excessive, because the plant is not now large enough for the city's needs. Notwithstanding this, the filters have operated successfully and have produced at all times water free from turbidity and well purified bacterially.

Quality of Effluent

No means of filtration has yet been devised capable of producing more perfect and regular purification than sand filters, where the water to be treated is susceptible to this form of treatment. General experience in this respect has been borne out fully by the results at Toronto. The efficiencies, especially after the irregularities of the first months of operation were past, have been as high as could have been anticipated, and as high as could be secured by any treatment that could be used.

Leakage From the Plant

About a year ago announcement was made in a most conspicuous way that the Toronto filter plant was defective, and that a considerable part of the water applied to it was lost by leakage. Investigation promptly showed the cause of the apparent discrepancy. The water passes through a meter before going to the filters and again upon leaving them. The meter at the inlet indicated 8 or 10 per cent. more than the meters at the discharge. The meter at the inlet was out of adjustment. The control apparatus placed beside it for the express purpose of permitting the detection of this kind of error had not been used. Apparently the superintendent of the plant did not understand its use. Bringing it into use promptly disclosed the error. When the meter was adjusted the difference disappeared.

There is, of course, some leakage from the filters, as there must be from all plants of this kind, but the leakage is not greater than is to be normally expected, and no harm results from it.

Conclusion

I hope I have made it clear, in the first place, that the Toronto plant is an exceptionally economical one from the standpoint of first cost; in the second place, that it is exceptionally economical to operate; and in the third place, that it is producing water of excellent quality, equal to that which could be produced by any system. The plant, although not elaborately finished with architectural and other auxiliaries that might appropriately have been part of a more costly plant, is substantial and adequate at every point, and capable of rendering the best of service up to the extent of its intended capacity.

Yours truly,

Allen Hazen.

Educational Facilities for the Clayworker

Editor Contract Record:

I have read with much interest your trenchant article, "Educational Facilities for the Clayworker," published in your issue of December 10 and think that you deserve credit for the able manner in which you have presented the question. It is certainly a most opportune time to bring forward the matter of better educational facilities for the rising generation and it is gratifying to note the announcement in your last issue that a department will be established in the new technical school at Toronto.

As you say, the technical school is calculated to promote particularly the interests of men especially adapted for certain practical work. We must not overlook the other side of the question, however. Unless further steps be taken, what chance have our sons to go through the University and not be lost to the industry? There seems to be no reason why a boy should not remain in the industry and be placed on a level with other professions. Is there not a certain amount of humiliation in the reflection that if our sons decide upon a course in ceramics they have to go to a foreign country? It is sad but true that the authorities of our province have made provision for every department in the constructional field except clayworking. The clay industry will

not recover quickly from this neglect. The average employee—of the brick plant for example—does not measure up to the average employee in other lines of industry. The right kind of workmen, with both muscle and brain power, is fast disappearing and it has been a source of great anxiety to the employer. Is not this state of affairs attributable directly to the low standard and status of the industry—unattractive remuneration, poor prospects, and last, but not least, inadequate educational facilities?

It is an excellent move to provide a course in the new technical school at Toronto, but judging from reports one can only conclude that it will be a purely local enterprise, redounding chiefly to the advantage of Toronto brickmakers, and it is a matter of some regret that the Ontario Legislature could not make this a government undertaking and amend the educational system so as to make provision for establishing a chair of ceramics in the University. Long ago the government of the United States awoke to a sense of their responsibilities in this regard, and, as a result, several cities in the Union are able to offer clayworkers an up-to-date University course. We lay claim to having one of the best educational systems in the world, but such a distinction is far removed from us. As to the value of such a course, no substantial objections can be brought forward. Professor Bleininger, a well-known authority whose word is recognized by the Canadian trade, says: "Technical education will not make a man better intrinsically, but it will make him look into the chemical actions and re-actions which take place and it will fit him to conduct his observations from both a scientific and a practical viewpoint." Mr. Richardson, of Columbus, Ohio, says: "I wish to give all possible encouragement to the movement in favor of starting ceramic schools. This is an enterprise which would amply repay all expense and help to develop the clay industries of the country."

Canada possesses within its bounds all the materials required to meet the requirements of the home market, but we cannot expect to make proper use of these materials without an adequate technical knowledge of how to work them. With a continued lack of such knowledge, foreign importations must necessarily increase. We are unable to meet the demand owing to inadequate manufacturing facilities, which, in turn, are due to insufficient information. The development of our clays and shales is of greater importance than that of any other minerals for the reason that they are identified so closely with our social needs and because they open up so many avenues for the employment of home labor.

Yours truly,

W. H. Freeborn.*

Are Canadian Clayworkers in Second Place?

Interviewed by the Contract Record in regard to educational facilities for the clayworker, a subject which has been exercising the minds of some of our readers lately, a prominent Toronto building supply firm made some rather caustic comments. The opinion was expressed that in this section of the country, at least, brick manufacturers, generally, were not desirous of taking any active part in a movement for educational facilities. Until the present season they had had so much demand for their common brick that there had been no reason to make any other product to increase their business. They could make enough profit on common bricks to pay them well, and although the profit on face brick of the better quality was proportionately greater, it involved different machinery, much more care in handling and the carrying of a considerable stock of different shades and qualities. As showing the subtleties practised in some quarters, one manu-

facturer was cited as having made a more or less successful attempt at making a high class of face brick from practically the same clay from which his pressed brick were made—simply giving them a little more heat in the kiln. The profit in this case was very considerable. Clayworking achievements on the other side of the border, it was contended, were greatly ahead of our own from the standpoint of cost.

Montreal's Good Building Record

The features of building operations in Montreal during the past year was the increase in the average cost of structures. The permits were 3,974, of a total value of \$27,032,097, as compared with 3,791 permits and \$19,408,690 in 1912, the increase thus being \$7,623,407, while the permits only gained three. The following shows the values month by month of the new buildings only: January, \$341,475; February, \$454,562;; March, \$656,705; April, \$3,063,259; May, \$2,138,128; June, \$2,031,975; July, \$1,349,000; August, \$1,951,697; September, \$1,738,670; October, \$4,462,650; November, \$3,695,706; December, \$1,260,980.

The issue of permits for three structures valued at over \$1,000,000 each, helped materially to swell the total, although the buildings are not yet completed, while the erection of ten large office buildings was also an important factor in this connection. There is evidence, however, that the demand for this class of accommodation has been fully met for the time being, and the present year will probably see a falling off in the skyscraper description of structures. Montreal has been building at a great rate, and the value of the permits has been steadily rising for a number of years. In 1900 it was \$3,089,400; ten years later it rose to \$15,715,859, and the 1913 figures show a gain over this of more than \$12,000,000. Nor does this adequately represent the position, for the figures of Maisonneuve, Westmount and Verdun, forming part of Montreal, are not included, owing to the fact that these places have separate municipal government.

On the whole 1913 was a good building year. Supplies were more plentiful than in 1912, when there was almost a famine in bricks, and when there was also a shortage in other materials. At present there is no indication of any ambitious plans for the current year, but there should be plenty of work in the way of houses and flats, for which there is an increasing demand, and which is not nearly being met. It is difficult to secure this class of property, many houses being rented before they are three-quarters finished.

With the restoration of Montreal's water supply, the demand for an investigation into civic administration, particularly of the water and engineering departments, has been strongly insisted on. A committee of citizens have retained Mr. John R. Freeman, president of the American Society of Mechanical Engineers in 1905 and consulting engineer of the New York Board of Water Supply, to make an independent report, and the Controllers state they will place any data they have at his disposal. Mr. J. E. Jamieson, Mr. R. S. Lee, and other engineers have made an inspection of the conduit and the aqueduct and reported on the situation. The Controllers have decided to construct a second conduit from the intake, and to do this it will be necessary to get power from the Quebec Legislature. The Controllers have further received authority from the Federal Government to connect the pumping station with the Lachine canal by means of a conduit, to be used in case of emergency. It has also been decided to make a connection with the Montreal Water & Power Company's system.

Messrs. T. Pringle & Sons, Ltd., the Montreal firm of engineers, have established in St. John a branch office for the Maritime Provinces. They say that business houses in the upper provinces have neglected good opportunities of which prompt advantage has been taken by American concerns,

Methods and Results of Waterworks Test for the City of St. Boniface, Man.

Contributed by G. L. Redmond, Winnipeg.

THE water supply of the city of St. Boniface, Man., is drawn from wells by means of a recently installed air lift pumping plant and stored in an underground reservoir. This latter is connected to the working sump by a pipe line which is controlled by a valve and may be opened or closed at will. The bottom level of the sump is below the reservoir so that the reservoir may be easily drained off in this way. The capacity of the sump is 1,005 gallons per foot of depth.

The test referred to was conducted for the city of St. Boniface in August, 1913, by E. Brydone-Jack, Consulting Engineer, of Winnipeg, in order to determine: (1) the capacity of the wells; (2) the efficiency of the pumping plant.

Tests were made on each well to determine, where possible,* (1) operating conditions; (2) the approximate discharge of water by weir measurement; (3) air consumption at the wells.

with 60 deg. notch, except in the case of well No. 13, where a rectangular form of weir was used.

Certain preliminary observations were noted in each case before beginning the actual test, viz., size of channel; length of channel; size of weir; distance of hook gauge above crest; temperature of water; zero head (i.e., height of water above zero on gauge at starting). Readings were then taken by means of the hook gauge every minute for a period of from half an hour to an hour on the different wells, the results being tabulated as taken, thus:—

Time	Reading	
4:00	.724	
01	.733	From the observed readings the true readings were found by subtracting the zero etc. etc. head at starting.
02	.757	

The first readings, of course, showed a gradual rise in rate of discharge, while the final readings showed a corres-

TABLE 1—DIMENSIONS AND CAPACITIES OF WELLS AS FOUND BY TEST

Shallow Wells								
Number of Well	1	2	3	4	5	6	9	10
Capacity Imp. gallons per min.						40.7	33.5	38.8
Depth of well below prairie level	59' 0"	60' 2"	60' 10"	59' 9"	53' 6"	19' 0"	91' 11"	92' 1"
Static head from prairie level	40' 6"	40' 2"	40' 3"	39' 9"		40' 4"	39' 4"	39' 2"
Pumping head from prairie level	43' 3"	54' 3"	44' 0"	43' 8"	51' 6"	45' 3"	40' 11"	43' 2"
Total lift	34' 9"	44' 11"	36' 6"	33' 11"	41' 8"	35' 7"	40' 3"	42' 0"
Depth of submergence	13' 10"	4' 7"	13' 10"	16' 1"	0' 0"	19' 6"	31' 0"	25' 4"
Percentage of submergence under running conditions	28.3	9.3	27.4	32.2	0.0	35.4	43.5	38.8
Size of discharge pipe	2"	2"	2"	2"	2"	2½"	2½"	2½"
Depth from pump to bottom of well	1' 10"	1' 3"	3' 0"	0' 1"	2' 0"	14' 3"	20' 0"	23' 8"

Deep Wells			
Number of Well	11	12	13
Capacity Imp. gallons per min.	79.2	66.4	305.4
Depth of well below prairie level	350'	350'	350'
Static head from prairie level	38' 11"	39' 6"	39' 3"
Pumping head from prairie level	303' 8"	323' 10"	109' 0"
Total lift	302' 5"	322' 1"	107' 9"
Depth of submergence	31' 8"	13' 10"	232' 4"
Percentage of submergence under running conditions	9.4	4.1	68.3
Size of discharge pipe	4½"	4½"	4½"

1. Operating Conditions

The readings taken under this heading were tabulated for purposes of comparison, thus:

2. Weir Readings

The shallow wells were piped directly to the sump into a 10 ft. x 12 in. weir channel with 60 deg. notch. In order to secure an even flow an ordinary baffle plate was introduced at the upper end of the channel and the hook gauge 4 ft. above the crest of the weir. The readings for the deep wells were taken at the reservoir in a 10 ft. x 18 in. channel

ponding decrease, the method used in compiling results being to take a section of the observed readings showing the maximum uniform flow, determine the true readings for this section and find the average reading.

The final results showing rate of delivery at wells were expressed in British Imperial gallons per 24 hours. These results appear in Table No. 2.

3. Air Consumption at Wells

The preliminary observations taken in this case were: size of orifice; static head; depth from discharge to pump. The actual readings were taken simultaneously with the weir readings at intervals of two to five minutes, the readings being taken for: pressure by gauge; temperature of air; height of water column (referring to a particular style of air meter supplied by the firm installing the compressors).

Final results showing air consumption at the wells were expressed in cubic feet of free air per minute. These, in conjunction with the weir readings, as shown in Table No. 2, give the number of cubic feet of free air per gallon of water pumped.

Test on Machinery

The air lift pumping plant consists of:

Two cross-compound air, motor driven air compressors, each driven by a 100 h.p., 550-volt, 3-phase, 60-cycle, 720 r.p.m., slip-ring type motor with external resistance for alternating current, complete with resistance starter, necessary switchboard, switches, meters, transformers, connections and frames.

* Wells 1-5 (averaging 60 ft. in depth) were not subjected to test 2 and 3 owing to insufficiency of water in the wells. Wells 7 and 8 were not connected. The remaining shallow wells, 6, 9 and 10, ranging in depth from 79 ft. to 92 ft., and the three deep wells, 11, 12 and 13 (360 ft. below prairie level), were subjected to all three tests.

Average prairie level equals El. 100.

One cross-compound air, simple duplex steam, steam driven air compressor.

One 42-in. x 10-ft. vertical air receiver, complete with pop and safety valves and gate valve on discharge.

Wells 1-5 are equipped with No. 4 Harris pumps; wells 6, 9 and 10, with No. 5 Harris pumps; and wells 11, 12 and 13, with No. 9 Harris pumps.

Capacity Test

In order to determine the constants of the apparatus used, a preliminary test was made under the headings: Pitot tube; intercooler; receiver.

1. Pitot Tube

Formula:

$$V = 18.3 \sqrt{\frac{h}{w \times a}} \text{ ft. per sec.}$$

Q = quantity of air in cubic feet.

h = inches of water.

w = air density lbs./cu. ft.

Preliminary Record:

Barometer reading (Aneroid).

Temperature of air inlet.

Section of air inlet.

Differential Pitot tube formula $Q = 183 \sqrt{h}$ cu. ft. per min. Readings h and Q were then taken every half minute for five minutes.

2. Intercooler

$$w(t_2 - t_1)$$

$$\text{Formula: } M = \frac{s(T_1 - T_2)}{s(T_1 - T_2)}$$

M = weight of air passing through intercooler lbs./min.

w = weight of cooling water " " "

t₁ = inlet temperature of water degrees Fahr.

t₂ = outlet temperature of water degrees Fahr.

T₁ = inlet temperature of air degrees Fahr.

T₂ = outlet temperature of air degrees Fahr.

s = specific heat of air.

$$M = \frac{260}{.071} \times \text{cu. ft. water} \times \frac{\text{diff. water temp.}}{\text{diff. air temp.}} \text{ cu. ft. per min.}$$

3. Receiver

$$P \times v$$

$$\text{Formula: } \frac{P \times v}{T}$$

P = lbs. per sq. ft.

v = cu. ft. of air per lb.

T = absolute temperature.

The following readings were taken every minute for five minutes: receiver pressure; receiver temperature; receiver contents; flow of air cu. ft./min.

Orifice Test

This test consisted of pumping the air into the receiver and then discharging it through the orifices directly to the atmosphere, so as to keep a constant pressure in the receiver. Only one compressor was tested in this way at one time, thus making it possible to ascertain the amount of air being pumped by same. Simultaneously the indicator cards were taken as well as the electrical readings, Pitot tube readings, intercooler readings and cooling water readings. The Pitot tube and intercooler readings differed from those of the preliminary test only in being more extended. Certain readings were taken on the electrical motors of compressors 1 and 2 simply in order to arrive at the efficiency and horsepower at pulley. The orifice readings on all three compressors were taken with orifices open 1/4-in. and 1/2-in. diameter, the direction of flow being horizontal. From these readings, with the help of tables, was calculated the quantity of free air in cu. ft./min. at 91 lbs.

The figures given below are the average results of the various tests for mechanical efficiency:

Electrical Compressors

Compressor No.	No. 1	No. 2
Electrical consumption in kw at receiver		
pressure 91 lbs. ...	72.0	74.5
at receiver pressure 100 lbs. ...	76.3	78.0
Horse-power consumption at receiver		
pressure 100 lbs., electrical efficiency, including belt, 89 per cent. ...	91.0	93.0
Mechanical efficiency ...	94.3%	90.65%
Volumetric efficiency ...	94.7%	95.3 %
Compression efficiency ...	*	*
Intercooler (difference of water temp. intake and outlet) ...	27° F.	21.8° F.
Quantity of air ...	470 cu. ft.	473 cu. ft.

Steam Compressor

(3)

Indicated h.p. of steam cylinders	
at receiver pressure 91 lbs. ...	90
at receiver pressure 100 lbs. ...	95.5
Mechanical efficiency ...	92.8%
Volumetric efficiency ...	95.2%
Compression efficiency ...	*
Intercooler (difference of water temp. intake and outlet) ...	22.5° F.
Quantity of air ...	475 cu. ft.

*Approximately 90 per cent., slightly lower than the guarantee carried by the compressors, for elevation at Winnipeg, but would satisfy the guarantee at sea level.

TABLE 2—RATE OF DELIVERY AT WELLS

Well No.	Well, Standing		Well, Pumping		Well, Rate of Delivery			Air Consumption at Wells			Cu. ft. free	
	Depth ft.	Static hd. ft.	Subm'g'ce ft.	Pumping hd. ft.	Cu. ft. per sec.	Cu. ft. per min.	Gals. per 24 hrs.	Gauge Pressure	Temperature	Cu. ft. per min. Compres'd	Free air	per gal. of water.
1	48.58	32.00	13.8	34.78								
2	49.50	30.83	4.6	44.90								
3	50.33	32.75	13.8	36.53								
4	50.00	30.00	16.10	33.90								
5	41.66	.25	.00	41.66								
6	55.08	30.75	19.50	35.58	.1089	6.534	58,700	12.875	70.0 F.	27.76	52.0	1.27
7												
8												
9	71.25	38.75	31.05	40.20	.0896	5.376	48,300	18.00	62.0	22.36	49.5	1.47
10	67.33	38.00	25.30	42.03	.1038	6.230	56,000	17.50	60.0	26.03	57.0	1.46
11	334.00	38.00	31.62	302.40	.2117	12.702	114,100	67.25	71.8	44.64	248.86	3.14
12	335.92	37.75	13.80	322.12	.1774	10.644	95,600	74.60	56.0	47.05	285.6	4.30
13	340.00	38.00	232.30	107.7	.8312	49.872	448,000	108.25	61.0	18.3	153.0	0.491

Unable to make test due to insufficient water in well.

Not connected.

Not connected.

The Decorative Possibilities of Concrete*

By C. W. Boynton and J. H. Libberton

IN the early days of construction, the architect and engineer appeared on the work under the title of master-mason. This individual wore long robes as an indication of his authority, and the designs on his trestle board are a matter of history. With the passing of the master-mason came the architect and

placed at the top of an eighteen or twenty-storey office building, which no one can see or appreciate except a possible few located in the offices upon the opposite side of the street.

This may be said of the Chicago Post Office (Fig. 1), with the exception that here the entire structure has been judiciously placed. It is well recognized that a structure of this kind occupies a maximum ground area with a minimum return in floor space and light area. This building was a large undertaking from an engineering standpoint, but whether or not it is an architectural success, few may judge because of the impossibility of viewing the entire building at one time. Of the same type is the Capitol at Washington, but so judiciously has it been placed that a full view may be obtained from all sides without obstruction. In the open, or upon the crest of a hill, the Chicago Post Office, even though inefficient in design, would be architecturally beautiful.

There is an old maxim to the effect that the designer should ornament his construction and not construct his ornamentation. This is an admirable saying, but it should be subordinated to another rule: that he should ornament his structure only if he lacked the skill to make it beautiful in itself. A structure of any kind that is intended to serve a useful end should have the beauty of appropriateness for the purpose it is to serve. It should tell the truth, and if the character

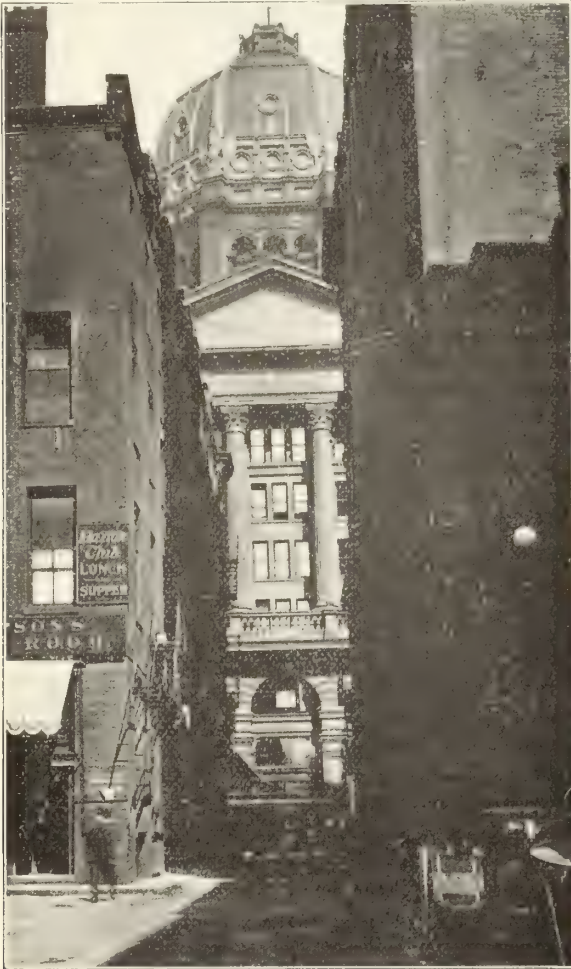


Fig. 1.—Chicago Post Office. West Front.

engineer, the one a worker in lines, and the other a worker in figures.

The combination is ideal; one specializing on beauty and the other, safety and efficiency. Too often, however, safety and efficiency receive first consideration, and the beauty only gets its share after costs have been carefully calculated.

In reality, the most common buildings of a manufacturing type can be made to conform to pleasing lines without the additional expenditure sometimes thought necessary. After pleasing lines have been determined, then comes the question of decoration. In many instances this is carried to extremes and we find exquisite examples of stone carving and cornice work being

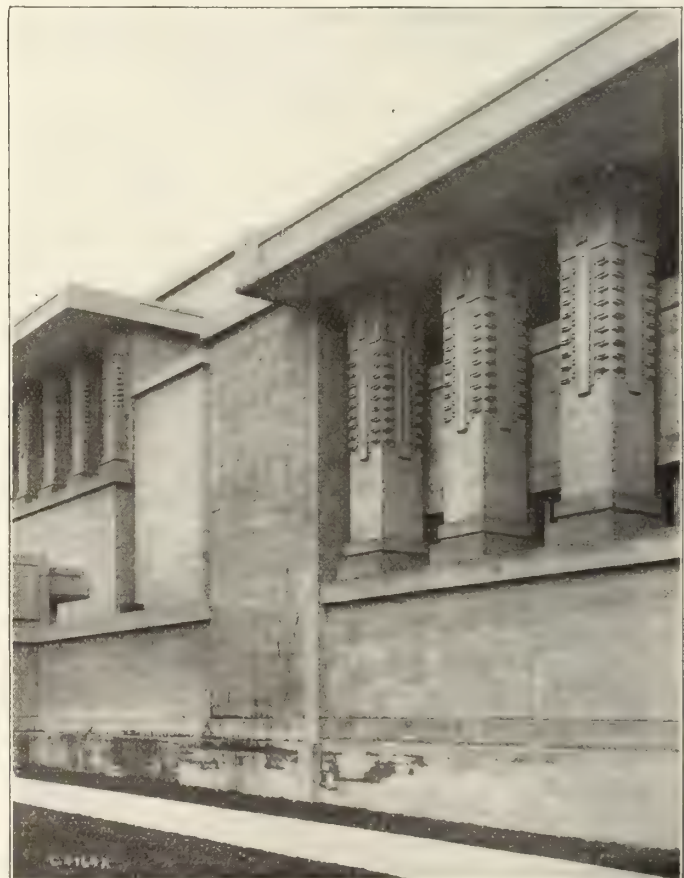


Fig. 2.—Detail of Unity Church, Oak Park, Illinois.

In the Journal of the Western Society of Engineers. Published in a slightly abstracted form in The Contract Record by the kind co-operation of the Secretary of the above Society, Mr. J. H. Warder, to whom we are indebted for the illustrations.

were such that it can be permitted to tell the whole truth, so much the better. It should preferably be beautiful and not beautified.

There is a certain charm about a massive structure almost irrespective of design. The sight of a pyramid on the desk would call forth no expression of interest or enthusiasm, but let this grow in size until it assume the proportions of those famous structures of Egypt and many pilgrimages will be made to view it. Of course the Egyptian pyramids are assumed to be the resting-place of kings, and the placing of the blocks required the use of more muscle or machinery than we at present have any knowledge of, but our idea of their beauty and grandeur obtains primarily from the immensity of the structures.

There is no reason; however, why mass should not be combined with decoration, provided the design is not made subordinate to the decoration. This combination has often been used very effectively. The question is, what medium shall be chosen? At the Unity Church, Oak Park (Fig. 2), the building is not only monolithic concrete but the ornamentation partakes of the same characteristics, having been cast at the same time and of the same material. In a building of this type, however, much attempt at decoration would be fatal and the unobtrusive style adopted detracts not in the slightest from the dignity obtained by large areas and massive construction. With a different style of building, such as the Administration Building at Washington Park (Fig. 3), the treatment may be entirely different and the concrete be called on to assume the most intricate shapes.

Both of these buildings show the same surface finish. The architecture determines the decoration. With conditions reversed and the decorations transposed, the effect would be ludicrous. In these buildings the monotony of the form concrete has been relieved by the use of a rather dry surface mixture which discloses the nature of the aggregate used. In work of this kind, particular attention must be paid to methods of obtaining uniformity of surface and absence of horizontal joint markings (Fig. 4), although the latter blemish is not nearly so noticeable on work of this character as with the wet mixture.

After all, the question of pleasing effects depends not only on the surfaces and the surface treatment, but on the combination of design with the surface texture. Compare, for instance, the factory of the Carter's Ink Company with that of the Piqua Hosiery Company (Fig. 5). Both have been finished with the same tools but the former shows infinitely more work without obtaining a pleasing effect. The difference seems to lie mainly in the appreciation of the possibilities in a molded material. A number of large surfaces have been substituted for the cut-up stone effect and the judicious use of the bush hammer has accentuated the massive and graceful design of the building (Fig. 6). And this effect has been achieved without any expensive decoration or form work than would be required for the most simple structure of reinforced concrete. On a smaller building, such as a subway en-



Fig. 3.—Concrete in the Administration Building, and balustrade, Washington Park, Chicago.

trance in Boston (Fig. 7), the method of dividing off the panels is more pleasing, possibly because the proportion of small areas to the whole is so much greater. Nevertheless, you will agree that the method of treatment used on the Piqua building is even superior on a small structure, such as the Weston Fire Station (Fig. 8), where also the panels have been bush-hammered, preserving the corners and margins intact. Consistent with its purpose, the entire structure is of rein-



Fig. 4.—Entrance detail. Administration building of the South Park Commissioners, Washington Park, Chicago.



Fig. 5.—Manufacturing building of the Piqua Hosiery Company, Piqua, Ohio.

forced concrete. When not carried to extremes, the judicious use of a few division marks, such as have been employed by the Witherbee Sherman Company in its power station (Fig. 9), relieves the plainness of design and forms a rather interesting framework for what would otherwise be a monotonous surface. Had the block surface been carried across the entire wall, the pleasing effect would have been ruined.

No doubt everyone is familiar with what seems to be the proverbial small town water supply tank, with its hemispherical bottom and sprawling legs—anything but an ornament in the community. This same type of structure was installed at Gary, Indiana (Fig. 10), but so well has it been concealed that the tower is a thing of beauty and possesses real architectural merit. The work of molding so large a structure in reinforced concrete was greater because of the forms required, the total height being 125 ft. But the finished structure justified the labor. The lower 25 ft. and the upper cornice are of cast concrete stone, made by



Fig. 6.—Detail of entrance to the building of the Piqua Hosiery Company, Piqua, Ohio.

George Rackle & Sons of Cleveland. The remainder is of reinforced concrete. The relief for the surface monotony is seen in the decorative work at the top and base.

Decoration, however, is not an essential of construction, as has been clearly demonstrated by the Spanish in the design of the adobe dwellings and missions. But adobe perishes and our interesting relics of former days will soon be a thing of the past. Noting the possibilities of monolithic concrete for preserving this architecture, Frank Miller has undertaken to petrify indefinitely, as it were, some of the most interesting details of the mission architecture developed by the Franciscan Fathers in California (Fig. 11). Thus when the last adobe wall has crumbled we still shall have a replica of the Campanile of San Gabriel (Fig. 12) and the imposing arches of San Fernando, these having been duplicated in the Glenwood Inn at Riverside, California. Little other material than concrete has been employed—except the roof tile, which undoubtedly lend color to the scheme and interest to the picture. On the roof is a famous collection of bells, over



Fig. 7.—Subway entrance, Boston.

300, dating back to 1278. It seems, consequently, particularly fitting that these old relics, after their furious experiences, may now rest content, enclosed and surrounded by a structural material which will preserve their last resting place intact through the centuries to come.

Of a mission type, also, are the rest or way stations of the Pacific Electric Railway, at Pasadena, California. These are fast replacing the old wooden rough and ready stations, none of which was consistent with the high class residential district through which the company operated. On both sides, a bench is built into the wall so as always to furnish protection from rain.

An unexpected test of building materials presented itself during the San Francisco earthquake, and the architect for the delightful bell tower on the Mills College campus, Miss Julia Morgan, states that it was one of the few buildings which remained undamaged in that vicinity.

Because it includes some of the most notable sculpture on the coast, the buildings of the

Throop Polytechnic Institute at Los Angeles, Cal., may have interest (Fig. 13). It is all of reinforced concrete, even to the tower, and was designed by Myron Hunt, of Los Angeles. The sculpture was executed in New York and cast in glue molds by a local company, the cost of this one item being something over \$5,000. Warm climates seem particularly suited to plain concrete construction, and its general adoption may partially be explained by the cool appearance of the plain surface.

Concrete, still in its formative state of development, is a comparatively new architectural material, although structurally it has been proving its permanence for many years. The particular reason for gratification comes in the new discoveries, and new uses to which it is continually being put. Every day there



Fig. 10.—Gary water tower, Gary, Indiana.

arises some Philistine who has discovered something new and worthy of consideration.

Frederick Squires, of New York City, had viewed with regret the present slab and beam floor construction. After several years of study, he devised a method of duplicating the most intricate of cast ceilings in solid concrete, with a decided saving of material. His scheme consists simply in employing reverse coffers of moulder's sand (Fig. 14) which are placed on the form before the concrete is poured. When the forms are removed, the panels are exposed, the whole being accomplished in one operation. Far more pleasing surfaces are obtained than were ever presented by the old plaster-of-paris method of applying previously cast panels to the work (Fig. 15).

A few years ago the theory of applying concrete



Fig. 8.—Weston fire station, Weston, Mass.

by means of a hose and nozzle met with derision, but every day we hear of more work being done by this method, the machine being designated as the "cement gun" and the concrete "gunite." An interesting piece of work has been accomplished by the Boston Elevated Railroad at the foot of O Street, Boston, where a



Fig. 9.—Power house, Witherbee Sherman, Port Henry, N.Y.



Fig. 12—Glenwood Inn, Riverside, Cal., looking from the street into the court-yard.



Fig. 11—Court-yard, Glenwood Inn, Riverside, Cal.



Fig. 14—Pouring concrete floor with panel inserts of moulded sand or plaster.



Fig. 13—Throop Polytechnic Institute, Los Angeles, Cal.

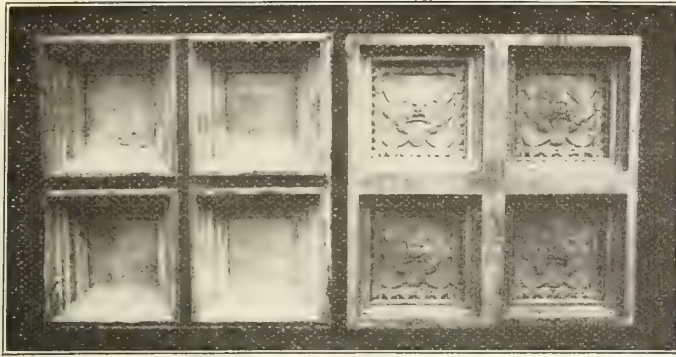


Fig. 15.—Sample of panelled ceiling work done with sand or plaster moulds.

garden fence has been constructed by this method. The base and posts are built of concrete poured into the forms in the usual way, the posts being relieved by protecting brick quoins (Fig. 16). The street face of the panels were shaped by means of a wooden form and each central panel was faced with steel. The concrete was applied from the rear with the cement gun, making the panels $2\frac{1}{2}$ in. thick and the styles 4 in. thick. The interesting point in the operation is that the entire panels are made in one piece and at one operation.

The very fact that concrete is simple in operation has caused many to undertake construction who are in no way fitted to carry it out, but with proper supervision even the most unskilled laborer can accomplish pleasing results. This has been proved conclusively by the work of the Aberthaw Construction Company at Port Antonio, Jamaica (Fig. 17). The fifty-six columns for the structure were cast in sand molds, then put into a lathe and turned down and polished so as to expose the coarse aggregate. An intensely red coloring matter present in the natural aggregate has given the walls a light salmon tint, which is very attractive. Particular attention is directed to the methods of elevating the concrete to the work, and judging from the smiling faces of the women shown in Fig. 18, the task does not seem to be over-tedious. For this hard labor they receive about 25c per day. Able-bodied men on the same work receive about twice this amount. Even with the lack of artistic appreciation which the people of this class possess, the building has been designed so as to be architecturally pleasing and



Fig. 16.—Cement gun construction on wall of the Boston Elevated Railway.

will undoubtedly have its effect in educating the people to a better realization of what constitutes good architecture and design.

A building should be fitted to the country in which it is to be located, and more and more attention is continually being given to the unity which must exist between the landscape and the layout of concrete structures which are to be added as permanent improvements. A striking example of this is to be found on the Duke Estate at Somerville, N.J. (Fig. 19), where white cement and white sand have been used in facing the concrete, in order, possibly, to give more contrast against the natural beauty of the surroundings. The bridge (Fig. 20) harmonizes with the rest of the work but might be improved if the surface markings were eliminated—the general lines accentuated by bush-hammering, or some one of the other numerous interesting surface treatments, to which concrete may be subjected.

In a similar manner the concrete posts which have been added to the Lake Shore Drive in Chicago, not only add materially to the dignity and beauty of this boulevard but are, themselves, better set off by being so well located (Fig. 21). Imagine this particular design on South Clark and Harrison Streets. For a while the posts would look entirely out of harmony

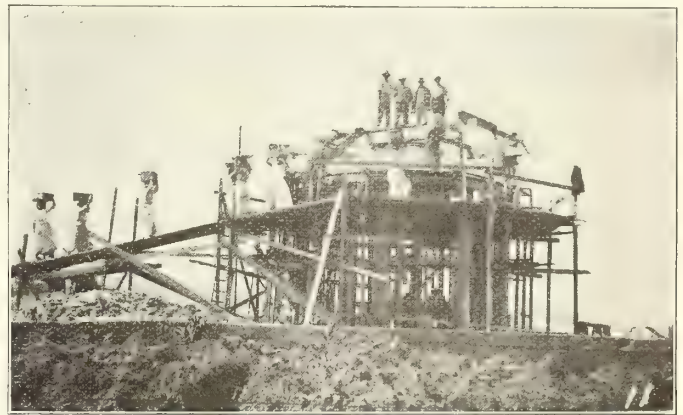


Fig. 17.—Concrete construction in Jamaica, showing the method of elevating concrete.

with their surroundings, but there is every probability that their advent would produce a desire on the part of the property owners to clean up the streets and buildings so as better to accord with the dignity of the lamp standards.

A note on the method of construction of these poles may be of interest since they are of reinforced concrete, cast in one piece including the base (Fig. 22). The surfacing is made of a special mixture of cement, dark red Wisconsin granite, and a small amount of mica, which is washed, after removing from the mold, with a weak solution of hydrochloric acid. The design is the result of a contest in the Chicago Architectural Club, the successful contestant being John Hamilton.

Of a similar nature is the work on the concrete railing around Jackson Park Harbor, also in Chicago (Fig. 23). Here, as before, the concrete depends for its beauty upon the surroundings rather than upon the excellence of the design, although it is well agreed that little could be added which would improve the dignity and solidity indicated by this superior example of a concrete railing. The white surface is obtained by the use of limestone screenings which emphasizes the important part the aggregate plays in determining the color of the concrete into which it enters.



Fig. 18.—Concrete elevators on construction work in Jamaica.



Fig. 21.—Lake Shore Drive, Chicago, with concrete lamp standards.

The attention which is being paid to the design of improvements which will harmonize with the surroundings may well be illustrated by the work of the B. & O. Railroad, on its Independence Boulevard viaduct, Chicago (Fig. 24). A total of some twelve to fifteen different designs were prepared and only after careful consideration was one finally decided upon, which the railroad officials thought would be suitable to submit to the Park Board. How well they succeeded is evident. Were the plain steel structure considered by itself, a realization could be had of the tremendous improvement which has been effected by the simple addition of the reinforced concrete covering. Some of the earlier work of the B. & O. Railroad shows an entirely different method of handling concrete, depending upon inlaid tile for decoration rather than upon the excellence of the design (Fig. 25). Of course, as this bridge is located on West Ogden Avenue, Chicago, there is nothing in the way of beautiful landscape to mention and probably the officials believed that a

little brightening of the concrete surface would relieve the monotony of a busy business street. But work of this kind is extremely expensive and can best be illustrated by a comparison of this bridge with the Independence Boulevard structure which is of 250-ft. span.

The Ogden Avenue Viaduct is 135 ft. between abutments, and yet the cost of concrete finish and inlay tile was greater than the total for the other structure of 250-ft. span. A simpler structure has been designed for Sacramento Boulevard (Fig. 26), but as this street is much narrower than Independence Boulevard, naturally an entirely different method of treatment was necessary and the lines have been made to follow somewhat a'long the Mission style.

Concrete surfacing not only protects the steel, making painting unnecessary, but it improves the general aspect of the structure. This is well illustrated by a very unimposing viaduct in Pittsburgh which recently was found to be rusting away for lack of paint. Feeling that the structure's existence was justified, the



Fig. 19.—Concrete retaining wall and balustrade on Duke Estate, Somerville, N. J.



Fig. 20.—Concrete arch bridge on the Duke Estate, Somerville, N. J.

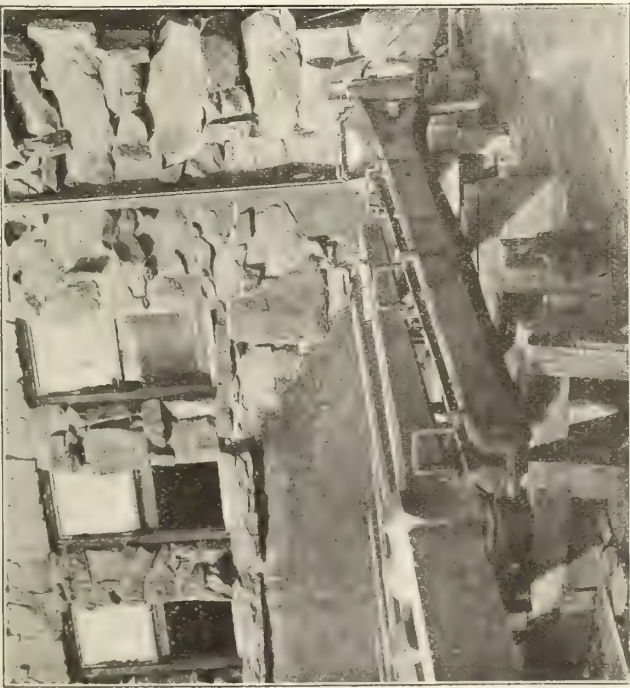


Fig. 22—Steel moulds for casting concrete poles.

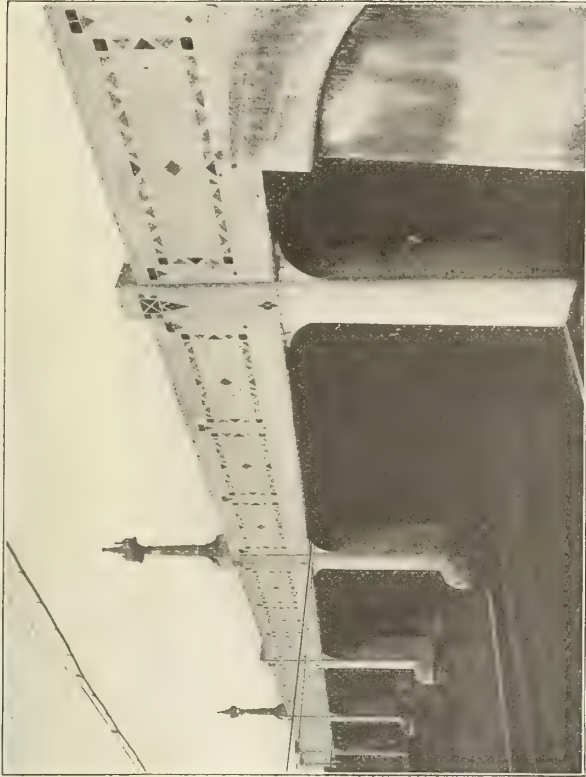


Fig. 24—Independence Boulevard Viaduct, Baltimore and Ohio Railway, Chicago



Fig. 23—Concrete railing around entrance to Jackson Park Harbor, Chicago.

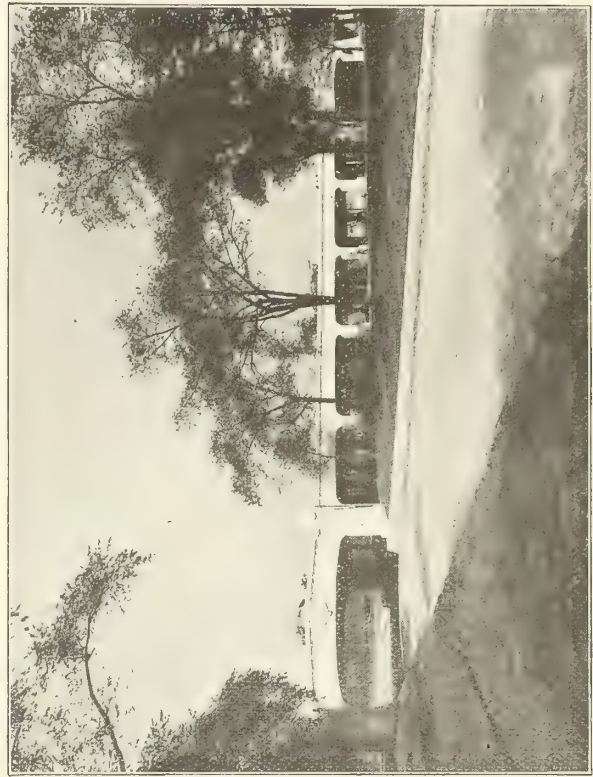


Fig. 25—Ogden Avenue Viaduct, Baltimore and Ohio Railroad, Chicago, showing tile inserts.

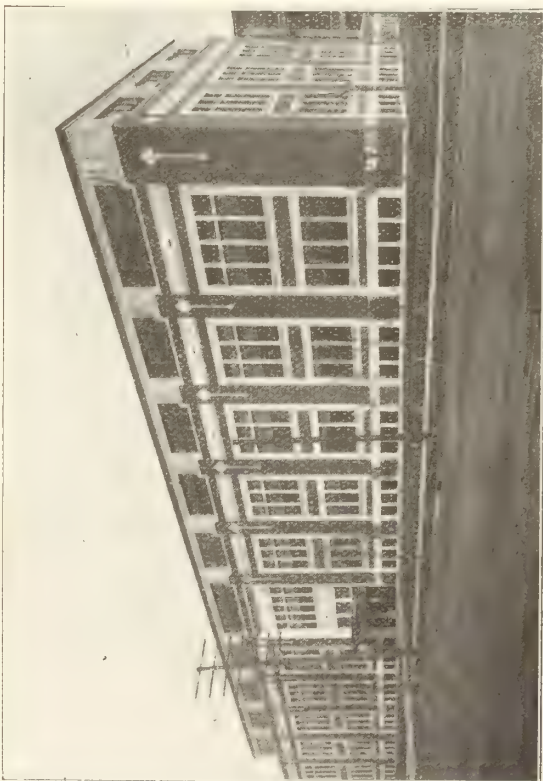


Fig. 30—Office Building, Packard Automobile Company, Buffalo, N. Y.

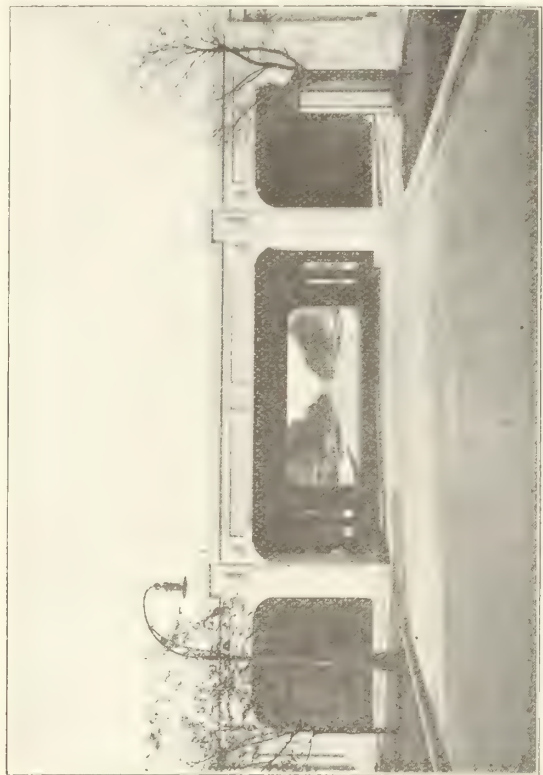


Fig. 26—Sacramento Boulevard Viaduct, Baltimore and Ohio Railroad, Chicago.



Fig. 29—Concrete arch bridge, Spokane, Wash.



Fig. 27—Euclid Avenue Viaduct, New York, Chicago, & St. Louis Railroad, Cleveland, Ohio.

officials made arrangements to cover the steel with concrete, in much the same manner as has been used by the B. & O. Railroad, although no particular attempt was made at architectural effect. Nevertheless, the appearance of the viaduct has been improved and its life undoubtedly materially lengthened.

Another railroad which is paying particular attention to the appearance of its viaducts is the New York, Chicago & St. Louis Railroad, under the supervision of A. J. Himes, Engineer of Grade Elimination. In the majority of instances the attempts have been thoroughly successful, although at Maysfield Road, Cleveland, the structure may be questioned as to its pleasing architecture. A great number of arches with short columns has not only made a large amount of form work necessary but has hardly justified the expense involved.

More pleasing work has been accomplished on the Euclid Avenue Bridge and at probably less unit expense (Fig. 27). In Cleveland, also, attention has been paid to the combination of landscape with structure, as indicated by the East Boulevard Bridge (Fig. 28), which is particularly well located so far as the con-



Fig. 28.—East Boulevard Bridge, New York, Chicago & St. Louis Railroad, Cleveland, Ohio.

tour and beauty of the surrounding country is concerned. The color which has been added to the arch and abutments tends only to brighten the picture and improve the general impression. The paneling for this bridge has all been finished with a bush-hammer and the red framing was obtained by mixing iron oxide with the concrete.

As has been stated, massive structures are impressive, irrespective of their design or location, but the interest is generally enlivened by such a waterfall and stream as is included in the photograph of the concrete bridge at Spokane, Washington (Fig. 29). The design is undoubtedly excellent and would stand alone, uncriticized, but the touch of romance which the scenery furnishes engages the attention and makes the picture more alluring than that of the Paulinskill Viaduct of the Lackawanna Railroad at Hainesburgh, N.J. Though equally well designed, it is surrounded by uninteresting prairie on every side, which, of course, cannot by any means be charged against the bridge design. (Concluded in next issue).

The great Ashokan aqueduct to supply the city of New York, now in course of construction, is the only modern hydraulic enterprise intended mainly for domestic and industrial use, that compares fairly with the Los Angeles aqueduct. The New York aqueduct crosses the Hudson over a thousand feet beneath the river bed, and it will furnish the metropolis with 500,-

000,000 American gallons daily at a cost, including its various reservoirs, of, roughly, \$170,000,000. The Los Angeles aqueduct has not much more than half the capacity of the Ashokan; but it is about twice as long, passes through an incomparably rougher country, and its cost, when completed, will, it is said, be less than one-fifth that of the great New York enterprise.

Reinforced Concrete Bridge Subjected to Heavy Test Load

A heavy test load on a 40-ft. reinforced concrete highway bridge was made in 1911-12 by the Illinois Highway Commission under the direction of A. N. Johnson, the engineer for the Commission. The bridge under test was a 40-ft. reinforced concrete girder bridge, in which the two outside girders and floor were of monolithic construction. It was designed for the usual loading of 125 lb. per sq. ft. uniform load or a 24-ton traction engine load distributed over an area 10 x 12 ft. It was completed about January 1, 1908, and was tested for small loads several times previous to July, 1911, when the load here noted was placed and continued from that time until September, 1912. Deflection and deformation measurements were made at different times during the entire loading. The maximum load was equivalent to 309 tons per girder, in addition to the weight of the bridge, and the floor slab carried an applied load of 418 tons for over a year without signs of serious stress. These loads amount from nine to thirteen times the maximum load that a bridge of this kind would be expected to carry in service. The maximum stress of the longitudinal girder steel as determined from the deformation measurement was about 25,000 lb. per sq. in. The stress computed for the same load under the assumption that steel for the girders takes all the tensile stress, is 47,000 lb. per sq. in. It is rather difficult with the irregular section of the bridge to determine the exact position of the neutral axis from theoretical considerations, but it is evident from the difference between the two figures given above that the concrete must have carried in tension a considerable part of the stress.—Engineering News.

Three-hinged skew arches of reinforced concrete were built over the Berlin-Spandau canal in Berlin, Germany, two years ago. One of the bridges has a span of 157½ ft. and a rise of 16.4 ft., with a skew of 35 deg. from square crossing (intersection angle 55 deg.); the ring is 26 in. thick at crown, and 42 in. thick at the maximum in the haunches. The other bridge has a span of 148 ft., a rise of 14.7 ft., and a skew of 22 deg. (intersection angle 68 deg.). The hinges are steel castings, and the hinge lines are parallel to the abutments, i.e., parallel to the canal axis, instead of being stepped. Dowels in the hinges prevent sliding along the joint, under the slipping force due to the skew between arch thrust and hinge line. The arches were calculated as statically indeterminate structures, there being horizontal and vertical torsion moments at the crown in addition to the crown thrust. The designer, W. Nakonz, states that these moments are small and it is sufficient to calculate as for a square three-hinged arch. The bridges were built by Dyckerhoff & Widmann. These bridges showed large crown deflection on striking centers, 2¾ in. in the larger bridge and 3½ in. in the smaller, with increase of span length by about 1 in. The abutments are founded on gravel. The acute angles of the arch abutments are subjected to excess thrust in such bridges.

To Set Out Spirals by Offsets from Long Chord*

By E. S. M. Lovelace, M. Can. Soc. C. E.

THE following method of setting out spirals was worked out by the writer when Division Engineer on the Quebec & Saguenay Railway, and such good results were obtained by its use that it may be of interest to lay it before the Members of the Society.

The location of this railway (on the section now under construction between Quebec and Murray Bay) for the greater part of its length follows closely the north shore of the St. Lawrence River, an almost absolutely level line being obtainable at the expense naturally of a great deal of curvature.

There are a couple of tunnels, and some of the smaller inlets have been crossed on rock filled crib-work, but for the most part a bench to carry the line has been blasted out of the rock.

The rock cliffs on the shore side rise almost vertically to heights ranging from one hundred to a thousand feet, and to reduce the cost of the work curves running from one to ten degrees have been used liberally, the connecting tangents being necessarily of no great length.

The profile of the natural surface on the centre line therefore presented the appearance of a comb with very long teeth and the cross-sectioning and setting out of the work for the contractors was in consequence very arduous, at spots dangerous.

The difficulty was largely added to owing to the tides, there being a rise and fall of about twenty feet in this vicinity. This meant that at some places, only when the tide was out, or, for about a couple of hours each day, could any work be even attempted.

Almost invariably the beginning of spiral was found to fall in a hollow, behind some large boulder, half way up a slope, or at some other equally undesirable point, and immediately in front, perhaps, would be a pinnacle of rock. In order to continue the spiral, a hub would have to be placed on top of this pinnacle and the whole spiral then swung from a backsight of say less than thirty feet. Add a couple more intermediate hubs in order to reach the end of the spiral (these were scarcely ever over two hundred feet in length) and it will be seen that, using the method of deflection angles, a considerable amount of field calculations would be necessary and then, in order to get results even approximately correct, careful chaining and most accurate instrumental work would be required and in the writer's experience neither the one nor the other is the easiest thing in the world to obtain.

The above facts are only mentioned to show the difficulty under such conditions attending the setting out of spirals in the ordinary way by deflection angles and the method about to be described suggested itself to and was put in shape by the writer to overcome some of such difficulties.

Afterwards it was seen that the method was capable of enlargement and applicable to other cases not at first foreseen.

By using the long chord of the spiral, the instrumental work, at least, at once greatly simplified itself,

for the angle CAP (θ on the accompanying diagram), being turned off in the first instance, it was only a question of prolonging a straight line to the B.C.C. (beginning of circular curve.)

Usually in a case such as described above, where the first hub is only a short distance from the B.S. it would be found possible to place also a reference mark forward or to the rear on the same line, and such mark, in place of the short back sight to the B.S. would be used for the further prolongation of the chord.

It may at once be stated that the writer does not for a moment advocate this in all cases, to the exclusion of other methods. On unbroken ground the spirals can be put in accurately enough and perhaps more expeditiously in the ordinary way, using deflection angles, than by any other method, but where the surface is very rough (requiring intermediate hubs), the experience of the writer is that the work is greatly simplified if the setting out of the spiral be done by offsets measured from the long chord.

In a trial location, through wooded country too, the advantage of this method is at once apparent, as it is only necessary to set off and cut out the long chord of the spiral, the rodman taking a shot to the right or left of the chord, should the ground require it.

Usually speaking, it will only be necessary to take such readings at the middle point of the spiral, which, as shown on the diagram, is always at a distance from the long chord of one-and-a-half times the shift, H , the shift being the distance which the main curve has been thrown back from the tangent.

The formulae (1) to (5) were submitted by the writer in a paper on Transition Curves read before the Society on December 7th, 1899, and as most of them are familiar and found in one form or another in other discussions, the writer does not propose to deal further with them here.

Number (6) however, $h = 4 HS \frac{(L^2 - S^2)}{L^3}$, to be used in connection with the method under discussion, is what the writer would particularly like to draw attention to. In it, given the shift H of the main curve from the original tangent and the total length L of the spiral, then h (the offset from the long chord to a point at a distance s along the spiral from the B.S.) can be calculated.

It is a maximum when $s = \frac{L}{\sqrt{3}}$ its value, h max, being $\frac{8}{9} H \sqrt{3} = 1.54 H$; when $s = \frac{L}{2}$, $h = \frac{3}{2} H = 1.5 H$, that is the offset from long chord to centre of spiral is always three-halves of the shift.

For use in the field No. 6 can be thrown into the form given in (7) $hn = 4 H N \frac{(A^2 - N^2)}{A^3}$ where the spiral is supposed divided into any number of chords of equal length. As spirals are not usually of a greater length than three hundred feet, it will not often be necessary to use more than eight, which would give chords of about forty feet in length, but of course when

required, any number (a) of chords, odd or even, may be used, and, after substitution in (7), the results worked out in the manner indicated.

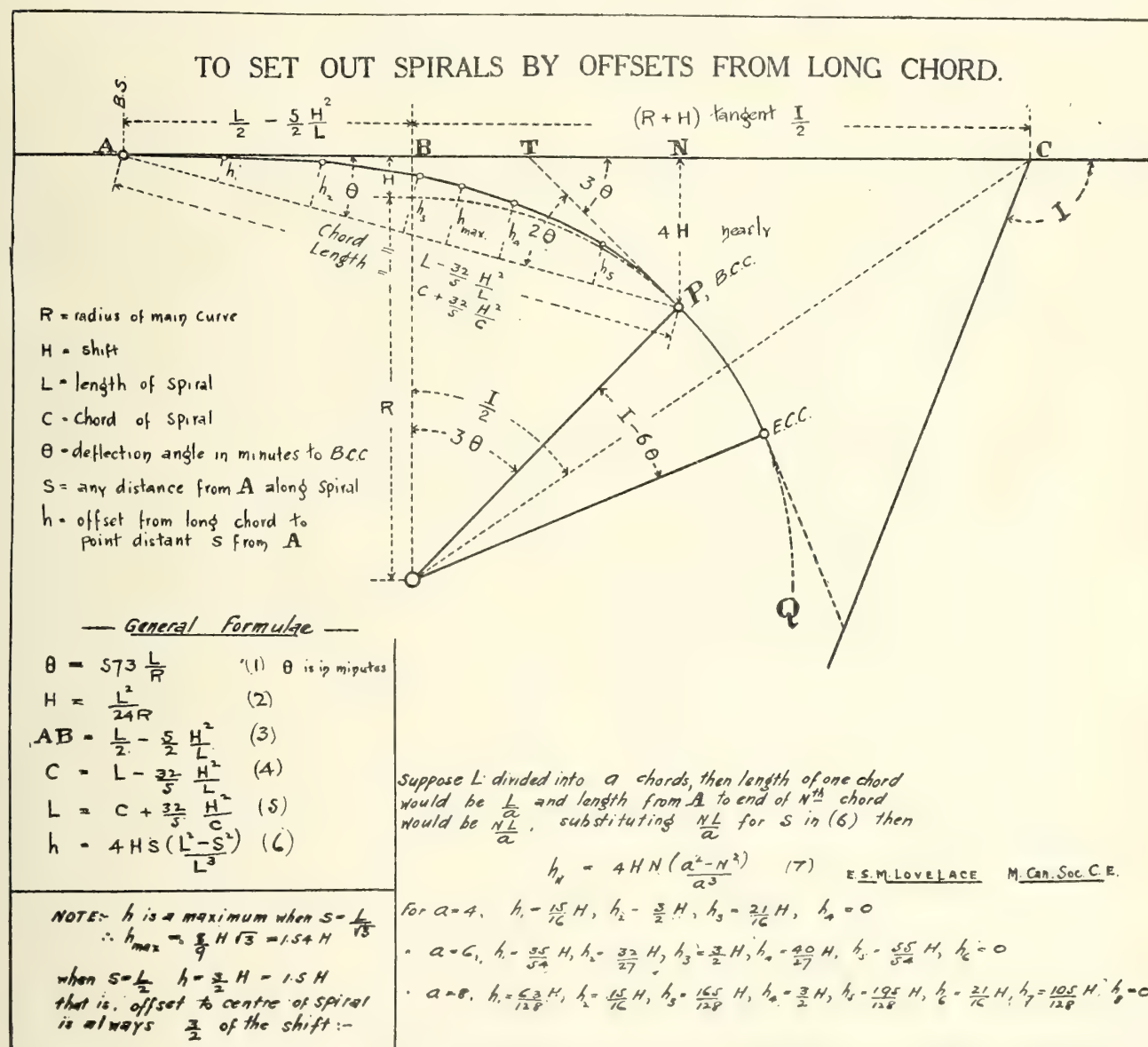
In most instances, however, using spirals of two hundred feet and under, four chords or $a = 4$ will be found sufficient, and then the offset to the end of the first chord will always be $\frac{15}{16} H$, to the end of the second or middle point of the spiral $\frac{3}{2} H$, and to the end of the third $\frac{21}{16} H$.

Using six and eight chords the results, as shown

(be the same small or great), there would be involved the question of measuring the offsets exactly at right angles to this chord, a thing tedious and very difficult to do even approximately in the field.

The proper way is to chain (using the chord length chosen) along the spiral, from point to point, in the ordinary way.

The picket man alone moves along the long chord holding (to steady it as the measurement is taken) the brass end of the tape against a picket, the front chainman with chain tightly drawn finding the correct position of the point by reading off on the tape the offset



on diagram, can be tabulated (expressed decimally perhaps to simplify field computations) and marked in the field book for reference.

A word with regard to the actual field work, for in the experience of the writer, engineers (especially young ones), so often use bad judgment, and choose in practice, so far as the obtaining of accurate results is concerned, the poorer of two ways of doing a thing.

For instance, while of course it would be alright to chain along the chord if only the B.C.C. is to be established (as when going through bush), it would be very bad practice indeed to do so when setting out intermediate points on the spiral, for, quite apart from the actual difference in length of the spiral and its chord

called out to him by the man at the instrument.

The transitman sights to the side of the picket or, what comes to the same thing, the exact end of the brass ring of the tape, the picket man moving this end up or down on the picket so as to keep it approximately level with the end held by the chainman.

It is only necessary for the picketman to keep somewhere near the position where a perpendicular dropped from the point being staked out would hit the long chord, for the effect on the measured offset of his being a few inches one way or the other would be inappreciable.

In giving final track centres, the position of the stake is first found, the stake driven, and then the exact

position of the tack on the stake can be found, by taking a fresh sight and measurement.

In this way it will be seen that it is feasible to set out points on the spiral easily with no greater error than say an eighth of an inch. On the other hand, if the attempt be made to put in the spiral in the ordinary way by deflection angles, any instrument man knows that it is impossible even with the most careful manipulation to set off the angles and be sure that there is not at least an error of say half an inch. While of course it may be argued that this is close enough for the most exacting practice, still the fact remains that of the two, that of offsetting from the long chord as outlined above is the more accurate method.

It frequently happens that the end of a viaduct or trestle is on a spiral and then, the accuracy and ease with which points on the spiral could again and again be laid down in exactly the same position as the work progresses, would tend to recommend the use in such a case of this method of offsetting from the long chord.

For electric tramways, etc., where the spirals are short, the above method and conclusions apply, the only difference being that it might be more convenient at times to use, in place of a transit, a piece of twine actually stretched to mark out the long chord, the offsets to points on the spiral being measured directly from this line.

When locating on side hill, or when, for one reason or another a line has to be very closely fitted to the ground, a problem frequently occurring is that case where a fixed tangent has to be connected with a curve already established. Should a simple curve answer the purpose well and good; but it will often happen that the requirements necessitate the use of a compound curve, and in that event, a simpler solution, the writer has found, is to at once employ, in place of the compound, one long, continuous spiral. While the elements of such a spiral could doubtless be worked out using the ordinary methods, yet nevertheless, the solution is given here as the question of setting out the spiral simplifies itself to some extent by using offsets from the long chord.

Referring to the diagram and formulae; suppose AC the fixed tangent and PQ the established curve.

Find T the point of intersection of the tangent to the curve at P with AC.

Measure PT and the angle $PTN = 3\theta$.

In the triangle PTA, the side PT and angles $PAT = \theta$ and $TPA = 2\theta$ are known and therefore the sides PA and TA can be calculated.

Also, $NP = PT \sin. PTN = 4H$ (nearly) is known.

Use $\frac{1}{4}NP$ as a value for H in formula (5), C being the side PA, and get the length L of the spiral.

Knowing θ and L, the radius of curvature r of the spiral at P is given by (1) $r = \frac{573 L}{\theta}$, θ being expressed in minutes.

An accurate value of H can then be found from

$$(2) H = \frac{L^2}{24 r}$$

TA is measured off along the tangent and A becomes the B.S. The spiral is then staked out as described above by placing the instrument at A or P and measuring the offsets from the long chord AP.

It should be noted that r, the radius of curvature of the spiral at P (supposing P has been chosen at random on the ground), is not necessarily equal in length to R the radius of the main curve; neither is it essen-

tial that it should be so, for the point P can then be regarded simply as a point of compound curvature.

If thought necessary, however, the position of the point on the established curve where r would equal R could be found by using the work done as described above upon which to base a new calculation, for

$NP + R \cos PTN - R$ would give the value of H for the required spiral

then $L = \sqrt{24 RH}$ by (2)

and $\theta = \frac{573 L}{R}$ by (1)

therefore the point required on the established curve would be found forward or backward from P according as 3θ is greater or less than PTN, the actual distance on this main circular curve corresponding to a central angle of $(3\theta - PTN)$.

Precisely the same problem as the above occurs at times when giving final track centres on construction. In such cases it is usually the result of incorrect measurements or inaccuracies in the instrumental work which have crept in during the progress of the work.

Of course it might be argued that such errors should not have been made, but the fact remains that to a greater or lesser extent they are always present and must therefore be considered.

What happens frequently is this: the points A and P on the diagram, that is the beginning and end of the spiral have perhaps been referenced at the time the location was made and therefore at a time when the natural surface of the ground was in quite a different condition from its present.

When track centres are being given these points are again run in but are found now not to have the same relative position to one another that they had originally.

The point A has perhaps moved a couple of inches to one side of its original position, and the point P an inch or two to the other, so that when the transit is set up at A and sighted to P the actual angle between the tangent and P does not agree with the original angle θ .

The discrepancy may be small and negligible, or it may amount to several minutes, in which case some adjustment will be found necessary.

Very often the easiest way to make this adjustment (more especially when the main curve is already lined up and its position therefore fixed) is to proceed in the manner indicated above, that is set up at P, run in and measure the line PT, measure the angle PTN, which is three times the new spiral angle, calculate the distance TA, measure it out along the tangent and thus get the new position of the B.S. The spiral can then be run in either by deflection angles or by offsets from the long chord. TP will of course be a tangent to both spiral and main curve at P, but as previously mentioned the radii of spiral and main curve at P will not of necessity be exactly equal.

Bellefontaine, Ohio, claims to have the oldest concrete road ever built. The road was built twenty years ago and is still in a good state of preservation, being still used for heavy traffic every day. The pavement consists of a 4-inch concrete base and a 2-inch wearing surface; the base being 1:2:4 machine mixed gravel concrete and the top a 1:1 mixture of cement and bank sand. The concrete base was laid quite dry, was thoroughly tamped and the top was laid closely, behind the base. This pavement was laid really in blocks five feet square. To afford a foothold for horses the surface, after being smoothed with a trowel was roughened.

Organizing and Executing the Construction of a Reinforced Concrete Industrial Building*—Part 1

By Leonard C. Wason

SEEING that sometimes the owner takes an active interest in the execution of the work, although he deals through his engineer or architect, it is of considerable importance to know his temperament and point of view. Greater harmony will thus be obtained. The engineer will do well to bring both parties together early and often. There is the owner who has not been seen at the time of that payment, and the one who is in evidence every day—the one who has a technical training and knows, and the one who does not know about construction, but thinks he does, and personally mixes into the work commonly considered as the engineer's. If the engineer is weak-kneed with the last-named type of owner expense and misunderstanding are almost certain to result, primarily because no man can serve two masters, and, secondarily, because an ignorant master, the owner, is never satisfied. If there is a very strong, fair-minded engineer who commands the respect of his client there is little trouble with any type of owner.

Then it is necessary to study the engineer or architect and consider his method of handling and supervising work. The methods of some engineers are radically different from those of others; this has a marked bearing upon the cost of the work and sometimes on its desirability to the contractor. The contractor must determine what sort of treatment he will receive. Nothing adds to the price of a bid like uncertainty, whether it be in the temperament of engineer and owner or in unknown construction problems.

In one case where a number of local firms were invited to bid on a certain large building for an architect who was well known always to rule in favor of his client, irrespective of the merits of the case, the successful bidder, after figuring full measure on all quantities, added this item—"Humor architect"; the item was 10 per cent. of the contract. It is safe to presume that all other competitors placed this contingency at a higher figure. Such a man could not get a reasonable bid from any one who knew him, and he certainly could not expect to let work advantageously to guileless strangers.

One of the great problems which the contractor has to face is that of the inspector who represents the engineer on the work. A thoroughly competent inspector is a great help to the contractor and very beneficial in the results obtained. An incompetent one is exactly the reverse. The writer recognizes the difficulties the engineer labors under in selecting his inspector. The duties are not hard, and to the man with ability, ambition and push, the close confinement to long hours of attendance on the work, with little to do except keep his eyes open, is too irksome to be long endured, even at a good salary, and this desirable type soon moves to what he considers better employment. The most important thing to consider in the appointment of an inexperienced man is his temperament. He must have an even temper not easily ruffled, be considerate yet firm, always diplomatic, and be capable of performing his duties acceptably to his employer.

The superintendent for the contractor is necessarily

better informed and trained in construction, an executive who is constantly directing others and quick to resist for the good of the service insubordination or usurpation of the duties for which he is held to strict account by his employer. In other words, he is trained to be an autocrat. This temperament does not take kindly to being bossed by a younger man admittedly with less experience. Therefore, the inspector must have the above-named qualities and also must not consider it a personal affront when his orders are overruled. He will make some mistakes which the engineer will correct, and many more, alas, which his chief will never hear about, although they make unnecessary expense and may affect his chief's professional reputation. He is put in a trying position, left too much alone and required to perform certain duties, but he must not go beyond bounds.

The very first step which a contractor must take in starting the execution of a job is selecting a general superintendent to handle the work. The type that is hired for a single job and discharged at its completion is not worth having. The really desirable superintendent is a development from experience, the one survival from many tried, and when once obtained a firm cannot afford to lose him. Some owners and engineers appreciate the value of personality so much that they have given the writer's company contracts under condition that a certain superintendent be put in charge.

Desiderata in a Building Inspector

If a building superintendent is to be successful he must combine at least seven qualities. He must have brains, special and technical knowledge of both direct contract and sub-contract work, tact, energy, honesty, judgment and good health. He must have a personality which drives to activity several hundred originally unorganized men who are without special interest in the company they work for or in the result accomplished, and with such tact and judgment as to weld them into a harmonious working force, cheerful and self-respecting, with high morals and ultimately with enthusiasm for the work in hand. He carries a care so great that he builds in full size, with permanent materials, the intricacies of design which trouble the engineer's drafting room to show clearly on paper; with an honor so fine that the company is ready to leave its reputation in his hands, to trust him with funds; and with special experience so trained that dangerous operations are carried on as a matter of routine, without worry to himself or the company, yet with a constant oversight of a thousand chances for accident or perhaps death which may occur to the men in his charge; with a forethought so great that he sees ahead and provides for the problems which are to come up perhaps months later; with a temper so good that he never loses self-control under the most provoking circumstances, and is able to take with the best of grace changes in his plans from the office, and to work in the close co-operation with the company which is so necessary to make it an effective contracting organization.

Such men have a temperament that responds quickly to criticism or praise. Praise comes sparingly, even when deserved, while criticism is freely meted

* From a paper published by the Association of Engineering Societies and abstracted by the Engineering Record.

out. The attitude of the engineer in this respect is reflected in the execution of the work. One engineer may call attention to a mistake with a letter that is harsh and ends with a sting, which leaves the feeling of injustice and soreness in the recipient. Another, in calling attention to a similar mistake, ends his letter with some expression like the following: "We appreciate your wish to make this work as satisfactory as possible, and recognize that this occurred through failure to understand my exact requirements." In response to such a letter as the first, the tendency is to do just as little as will satisfy the engineer and take your own time about it. But, as the writer knows from personal experience, in response to the second letter, you jump to correct the trouble cheerfully, quickly and without comment, and also sometimes do more than was asked for.

The Contract

The type of contract is manifestly of considerable importance. It is the firm opinion of the writer that the usual type of lump-sum contract obtained in competitive bidding does not give an owner the best results. With competitive bidding open to all, the lowest bidder is liable to be one who does not use the best of methods, is looking for all sorts of short cuts, and is frequently one with a limited amount of experience and capital. It has been often noted that those new in the reinforced concrete field underestimate the difficulty and cost and do work badly at first, no matter how experienced in other lines. The lowest bidder is squeezed to a figure where it is known he cannot make much, if anything, and there is every incentive to save and slight. This condition of necessity encourages mutual suspicion and antagonism before the start; therefore, the best results are impossible. No amount of careful inspection can make an inexperienced or incompetent contractor turn out thoroughly first-class work.

On the other hand, under the cost-plus-fixed-sum-for-profit type of contract the interests of the owner, builder and engineer are one. Work obtained in this way is certain to be much better for the same cost; even if the cost is slightly greater, the owner has the assurance that he is getting much more for his money. The majority of manufacturers whom the writer knows look upon a mill building as a tool to be used in a manufacturing process, rather than as real estate, and want to get a thoroughly first-class tool rather than the absolute last dollar knocked off the first cost of real estate, and, therefore, believe the extra cost justified. The engineer can examine the estimate of cost as prepared by the contractor, discuss savings or changes, and can see places where he is willing to cut the design when he knows that there is not going to be still further cut in the execution of the work. When he knows that the work is going to be executed exactly as designed he can design with greater precision and economy than when he has to provide extra strength or size of members to allow for a possible lack of quality of materials and workmanship by some unknown person who may have the execution of the work in hand. The work can be carried on also much faster under this method of close co-operation than under the other, where there are likely to be misunderstandings which must be adjusted before the work progresses further. What the contractor has to sell is service, and what the owner wants is results, and where this mutuality exists both parties can accomplish the end which they are striving for.

If the owner wants to start as soon as he engages an engineer and before plans are started, he can save about six weeks' time with no serious difference of cost on the cost-plus-fixed-sum basis.

The engineer and owner do not sufficiently appreciate that the builder or contractor is largely a broker buying materials. With an office building, for instance, the general contractor may not handle more than ten per cent. of the contract price as direct labor. The rest is materials bought and sub-contracts let. With reinforced concrete the percentage of labor is larger than in any other building operation. It averages about 35 per cent. of the cost. The contractor, therefore, realizes the necessity of a first-class purchasing department.

Preliminary Work

When a contract is awarded and a set of plans received from the engineer a considerable amount of work is done in the main office, beginning long before any work is started in the field and continued during the early stages of construction in two departments—the designing and the purchasing.

The function of the designing department is to take the complete set of plans and make a careful study of these in regard to designing forms, tabulating steel and illustrating and tabulating other materials, such as doors, windows, architectural iron, etc., where this is not done in the engineer's office. The location of construction and contraction joints is studied, and on rare occasions the structural design is reviewed. In the writer's practice it is common to close a contract and start building before any working drawings are made. Then the work and responsibility thrown on the designing department are very great.

Chief among the minor features not shown on the plans are the means to be provided to prevent cracks, which mar the appearance and are often a source of annoyance, though seldom a cause of structural weakness. There are sometimes cracks caused by unequal settlement of foundation. Sometimes a part of a building is on piles and part on earth. Where they join it is hard to foresee and provide such an amount of bearing that the whole will settle evenly. It is usually best to provide a broader bearing on the less rigid material than theory dictates; then unsightly cracks may be avoided by very rigid tying of the building together with reinforcement, against pulling apart longitudinally or shearing. This requires both horizontal and diagonal reinforcement with a minimum quantity, equal to at least one-half of one per cent. of area of concrete.

Another way to overcome the same difficulty is by building a joint vertically clear through the structure at this point and designing the members of the structures on either side so that if settlement does occur they will not crack. This was done with satisfactory results in a recent building where one end rested upon sand, and center on ledge and the other end on clay.

On the ground of cheapness of construction, it is almost always better to put curtain walls in after the frame is up; the work then goes ahead much faster. Weather-tight joints can readily be made, and the joints between the frame, that is, the columns and floor, can be concealed so that no unsightly crack is visible.

Another point of design which may sometimes be advantageously discussed by the engineer is that of roof construction; whether the structural part shall be flat and covered with cinders, to give a proper pitch for drainage, or whether the ceiling shall be pitched

and the fill avoided. In construction the most serious objection to the first method is that so much time elapses between the casting of the roof and the waterproof cover of tar and felt over the cinder fill that a considerable quantity of rain collects on top of the roof slab. These slabs, while not absolutely watertight, are tight enough to hold a considerable quantity of water. On some jobs holes had to be drilled from ceiling to drain roof slabs. In one building water dripped from the ceiling after it had been waterproofed for a period of five months, due to the collection of water on the slab in the cinder fill. In another case there was some dripping even after two years. This is a matter entirely beyond the control of the contractor.

It is somewhat common to put wall beams above the floor on account of letting in light at the ceiling line. Then the question arises whether the beams shall be cast with the floor or be cast separately. It is generally cheaper and of equally good construction to cast the wall beam as a separate operation, allowing the ends to rest in rebates in the columns and suspending the slab below by means of stirrups. Provision can be made for continuity by casting some holes in the columns above the floor at the proper points, through which the reinforcement for negative bending moments will pass, allowing the ends to extend well out in the adjacent panels. When properly grouted into place and panel cast this will be as strong as if cast as a monolith with the floor.

In one building of large size, in a single floor there

were in the original design received 455 different sizes and styles of beams. The designing department of the writer's company found it possible, without impairing the result to be accomplished, to reduce these to less than a tenth of the original number, and by co-operation with the engineers finally succeeded in reducing the number to 52. If the engineers realize that in the building of wooden forms for maximum economy these are made from plans drawn to scale at a bench on the ground and assembled in place without the use of any tool but a hammer, it will be seen that almost as great precision must be used in construction as with structural steel.

The question of change of size of columns in every storey, or once in two or three storeys, is one of cost. The expense of changing the forms is usually greater than the cost of concrete saved on small columns where the reduction is less than three inches, and on large columns where the reduction is less than two inches. Therefore, it is not often economical to change the size every storey. Often when the column is reduced it is desirable to use ahead the size of lowest storey columns in order to avoid the expense of splicing out beam and girder sides and bottoms. Sometimes when the upper floor has a lighter load than the lower it would be possible to reduce the size of beams. Economy dictates that the depth may be reduced but not their width, because this would require splicing out all the floor panels and joists, which is more expensive than the saving in concrete.

General Methods of Repairs and Renewals in Road Work*

By A. W. Dean†

REPAIRS and renewals of highway surfaces are matters of as great importance as the original construction—possibly greater, in that construction may be deferred for a period without serious loss, whereas repairs must often be made immediately when the necessity occurs. If a highway is properly built it will require very little attention for some time, but if its improperly built, repairs are called for immediately and renewals soon follow. A properly built highway is one properly designed to meet existing and anticipated traffic and other conditions, built with good quality of material and workmanship. Obviously, not every highway is or can be built properly, hence the problems of repairs and renewals are constantly before us.

Let us first give attention to the dirt road, of which there is a greater mileage than of any other single type. Apart from the bridges and culverts, the repairs on such roads may be made very largely by the use of a road drag, with the occasional use of a road machine. The drag is a comparatively new type of implement, but has been so widely advertised that it is perhaps not necessary to describe it at this time. Whether made of split logs, plank or steel, it is serviceable and should be used when the dirt is full of moisture, but not sufficiently so to be muddy. Frequent dragging will keep the average dirt road in good condition, and the road machine should be used only when it is desired to in-

crease the width of section. Repairs and renewals are synonymous terms in this method of maintenance of dirt roads, in that every time a drag or road machine is used for repairs, the surface is renewed to some extent.

Sand-clay roads being essentially improved dirt roads, are repaired in much the same manner, but with perhaps more care. In addition to dragging, it becomes necessary to add more clay, or sand, or both, to strengthen weak spots that may develop. Renewals are made by adding to the entire surface, without previous preparation thereof, a layer of sand and clay properly proportioned, and mixing same by harrowing.

Gravel Surface

Next in order of permanence is the gravel surface. So widely varying types of surfaces are described as gravel, that it might be well to limit the definition of gravel as material in which the mixture of round stones and particles is quite uniformly variable in size from minute particles to stones two or three inches in diameter. Repairs of gravel roads are frequently made, to some extent, by the use of the drag, but should not be made with a road machine except, as in the case of the dirt road, when it is desired to widen the travelled surface and sometimes to lightly smooth the surface. Whenever it is used for widening the travelled section, the material that is scraped from the sides should in no case be left on the road surface, but should be either carted away or thrown outside of the section worked. Renewals are made by simply spreading additional gravel over the surface without previous preparation thereof, and watering and rolling, if possible, but if

* Paper presented at the tenth annual convention of the American Road Builders' Association, Philadelphia, Pa., Dec. 9-12, 1913.
† Chief Engineer, Massachusetts State Highway Commission.

not possible, permitting the traffic to compact the material.

Maintenance of a broken stone macadam road whenever constructed by the usual method (ordinarily termed as water bound macadam) is a more or less difficult problem, depending upon the traffic that it has to withstand. If the traffic is sufficient to wear out the surface rapidly and cause so-called "pot-holes" to appear, the practice of repairing or renewing it by adding stone without a foreign binder, is questionable. If, however, such traffic conditions do not exist, repairs are made by loosening the upper surface of the section to be repaired, adding broken stone of small dimensions, with sufficient stone dust to fill the voids, and compacting by rolling. Renewals are made by adding more stone to the entire surface in the same manner that the upper course of the road surface was originally constructed. If the thickness of the newly added surface is less than 3 ins. better results are obtained by loosening the old surface, reshaping and rolling it before adding the new surface.

The changes and development in the use of motor vehicles, trucks and tractors, make it appear advisable, however, in the repairs and renewals of macadam roads, to use a bituminous binder. This use of bituminous binder has become quite universal in many sections of this country during the last few years, and the problem of repair and renewal of bituminous bound or surfaced highways, is gradually, through experience, becoming simplified. Repairs on a bituminous blanket or thin surface coat may be made by covering the section to be repaired with a thin coat of asphaltic oil or tar as the case may be, and immediately covering with pea stone, fine gravel or coarse sand. This is assuming that the repairs consist of renewing comparatively small sections of the coating that for any reason may have disappeared. No general fixed method can be described for making repairs due to imperfect workmanship, the use of too much bituminous material, or the irregular distribution of material, each case having to be treated in such manner as experience may have shown to be best. Renewals of bituminous carpets may ordinarily be made by a repetition of the usual process of constructing such carpets, except that it is advisable always to use less bituminous material per square yard for renewal than was used in the original carpet.

So-called sand and oil mixed road surfaces are either repaired or renewed by the addition of mixed material of the same quality and density as that used in the original surface.

Bituminous grouted or mixed macadam surfaces should not require early or frequent repairs or renewals if designed and constructed properly in the first instance. Should the necessity for repairs arise, however, they are ordinarily made by the removal of all disintegrated or imperfect portions of the surface, and by substituting therefore a mixture of bitumen and small broken stone, the mixture being made either by mixing previous to application or by spreading stone and filling the voids by pouring. In renewing bituminous macadam surfaces it is not ordinarily necessary to break up or remove any of the existing surface, but the new surface may be added by spreading directly over the old surface. If, however, the old surface in addition to having become worn thin is worn very irregularly, it is advisable to loosen up, scarify, reshape and roll the old surface before adding the new surface material.

The repair of cement concrete surfaces is a comparatively new problem, as such surfaces have not been in use for many years, and such repairs as have been

required have been due to imperfect workmanship or material. If the defects to be repaired consist of badly disintegrated sections, they cannot be permanently repaired except by the removal of all material in the sections to the full depth of the surface, and replacing same with new and proper concrete. If the defects to be repaired are minor, however, and consist merely of small depressions, they may be repaired by filling the depressions with a bituminous mixture. When a cement concrete surface becomes worn sufficiently to appear to require renewal, it is impossible to renew same by adding a new thin coat of cement concrete mixture, therefore, it may be said that a cement concrete surface cannot be renewed with the same type of surface, but must be entirely removed and a new section constructed. This would be expensive, however, and it appears that the proper method for bringing up an old concrete surface is to cover it with a bituminous bound surface of some type, thereby creating a bituminous surface in place of a cement concrete surface.

Block pavements of all kinds can be repaired or renewed only by the entire removal and replacement of the sections to be repaired or renewed.

To go into details of all the methods for repairs and renewals of all types of surfaces would obviously require a document of much length, and the speaker has not attempted to cover details, but has merely presented enough material to bring out points that might lead to a discussion of the features of most interest.

The Provincial Courthouse Addition, Vancouver

THE extensive new addition to the provincial court house at Vancouver, upon which work is now practically completed, embodies constructional features of a type which place it in a leading position among the many fine buildings of recent erection in various parts of the city. The structure was designed by Mr. Thos. Hooper and is in complete harmony with the architectural scheme of the main building at the rear of which it has been erected. The frontage is 86 feet on Robson street and the depth is 110 feet on Hornby street. Granite is used entirely for the exterior facing of the ground floor, the walls of the upper storeys being of Haddington Island stone. The design of the main entrance has been carried out in a manner strictly in keeping with the dignified appearance of the whole scheme. A columnar entrance portico faces on Robson street, the



New extension to provincial courthouse at Vancouver.

approach consisting of a flight of granite steps, with granite pedestals at each side, upon which will be placed bronze electroliers ten feet in height.

The main entrance hallway is panelled from floor to ceiling in Alaska and Vermont marble, and the corridors throughout are wainscotted in the same material to a height of 5 ft. 6 in., marble being also employed in the staircases, which have wrought iron balustrades. All floors are constructed of 6-inch concrete reinforced with Clinton fireproof fabric, and covered with interlocking rubber tile in the corridors, the floors of the departments being covered with 1 x 8-inch shiplap and finished in 1 x 3-inch fir. The materials used for roofing purposes consist of copper, asphalt and gravel.

A connecting corridor, 40 feet long and extending to the third storey of each building, affords communication between the new addition and the main structure. The lower part of this corridor is constructed of solid granite and is lined in the interior with Haddington Island stone, and floored in tile. A duct connects the basements of the present building and the new addition, while the ground floor forms a colonnade with arched stone work between the columns. The upper portion is entirely enclosed.

The ground floor is occupied by the Stipendiary Court, barristers' rooms, offices of the provincial inspector of dykes, provincial fire warden, provincial road inspector, and others. The first floor contains the offices of the government agent, provincial timber inspector, assessor and official scaler, with vaults adjoining. Located on the second floor are the large and small Supreme Courts, and a number of offices and apartments in connection therewith. The offices of the game warden cover the greater part of the third floor, in which are also situated several apartments which have not yet been assigned to any special purpose.

The heating of the addition is provided by connection with the plant located in the basement of the main building, the Webster Modulating System with Powers regulator attachments being employed throughout. The Webster ventilating system has been installed in the addition.

The main entrance doorway and all double acting doors in the building are fitted with "Highmac" spring hinges, invented in Vancouver and manufactured by Harcourts, Limited, of Birmingham, England.

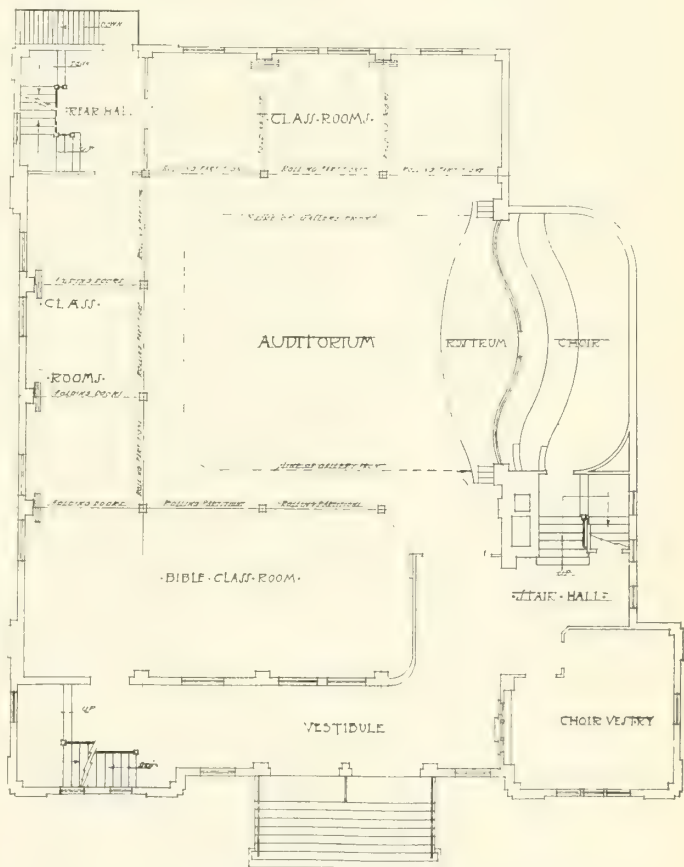
Messrs. McDonald & Wilson, who were the contractors for the main structure, are also erecting the addition, the cost of which will amount to about \$400,000. It is understood that plans have been completed by a Vancouver firm of architects for a second addition, of corresponding design and similar cost, upon which active construction will probably be inaugurated early in March, the steadily growing business of the provincial authorities necessitating still more extensive quarters.

A question which must often have occurred to engineers who have followed with any minuteness the construction of the Panama Canal, and who have noted the enormous outlay which has been necessary upon machinery and equipment plant is, "What will become of all this costly equipment when the Canal is once completed?" A partial solution of the problem has now been afforded by the announcement that a large portion of the Canal machinery and equipment when finished with will be sent to Alaska for use in railway and dock construction and coal mining. The Isthmian Canal Commission has been asked to supply the United

States Senate with information showing as nearly as possible the amount, character and value of construction machinery and material which will be available on the completion of the Panama Canal.

Canada's First Reinforced Concrete Church

WHAT is said to be the first reinforced concrete church building erected in the Dominion has recently been completed for the Kitsilano Methodist congregation on the corner of Second avenue and Larch street, Vancouver. Comprising the first unit of a large church to be erected later at this location, the present building, which will eventually be utilized for Sunday School and social purposes, has cost \$28,000 and will accommodate 720 people. The structure rests on 18-inch square reinforced concrete columns, and has 7-inch walls. It combines an auditorium with a Sunday school building and church home series of apartments and parlors. Ample stairways, entrances and exits are provided



Ground floor plan, Kitsilano Methodist Sunday School.

throughout. The interior finish consists entirely of cotton-wood mahogany, a product of British Columbia manufacture. The heating and ventilation of the building is accomplished by means of a No. 90 Pease Economy Heater, designed and installed by the Pease Pacific Foundry Company, of Vancouver. This equipment forces air over the heater with a large blower, having a capacity of 10,000 cubic feet per minute and changes the air in the building six times an hour. The system is designed in a manner which permits the use of the blower for ventilation purposes during the summer months. The artificial illumination of the interior is provided by an indirect system of lighting. Mr. Thos. Hooper was the architect for the building and Mr. S. Olsen had charge of the general contract.

Much Activity in Prospect at the Coast

Conditions Generally Satisfactory—Large Hospital Expenditure at Vancouver—Extensive Harbor Works Planned at Kitsilano—Victoria Busy

Correspondence of the Contract Record.

Vancouver, B.C., Jan. 6, 1914.

JUDGING from the number and character of the various building projects upon which work has been scheduled to commence at Vancouver, Victoria and other points in the province within the next few months, the prospects for the early part of the new year in the British Columbia field may be described as satisfactory, despite the continued tightness of money at the Coast. The construction programme of both the Dominion and Provincial governments in British Columbia for the ensuing year are of unusually wide scope and should contribute in a marked degree towards the prosperity of the province as a whole.

As far as Vancouver is concerned, the volume of building projected compares very favorably with that of the beginning of the past two seasons. Some of the large contracts on which it is announced that an early start will be made are the new additions to the general hospital, costing approximately \$200,000; the proposed sub-postoffice in Mount Pleasant representing an outlay of \$100,000; another new addition to the provincial court house, costing about \$400,000; the proposed immigration shed, estimated expenditure approximately \$300,000; a new drill hall in Grandview costing about \$250,000; the British Columbia University buildings, representing an expenditure of several millions of dollars; proposed six-storey reinforced concrete warehouse for Cope & Son, electrical contractors; a \$40,000 annex to the wholesale warehouse of Kelly Douglas & Company; a six-storey cold storage warehouse for the Vancouver Prince Rupert Cold Storage Company. These and other smaller contracts will help to swell the Vancouver building totals during the next few months.

Then there is also to be considered the bank and office building, which is being contemplated for early construction by the Canadian Bank of Commerce, and two other large buildings of the same nature which it is reported will be created in the near future by the Merchants Bank and the Royal Bank, details of which are not at present available, but the sites for which have already been secured in central parts of the city.

In Victoria there is a large amount of building construction contemplated by the Dominion and Provincial authorities, in addition to several extensive contracts which are being planned for an early start by various private interests.

While it is the intention of the Vancouver civic authorities to submit very few improvement by-laws for the coming year, there is expected to be almost five million dollars available for general municipal work.

The value of building permits issued at Vancouver during the year 1913 indicates a considerable falling-off compared with the figures for the previous twelve months, permits to the number of 2,017 being taken out, representing an outlay of \$10,423,547. In 1912 there were 3,213 permits issued, valued at \$19,428,432.

Following the recent announcement that the Canadian Bank of Commerce had purchased the south-west corner of Main and Pender streets, Vancouver, comes the statement from the local officials that instructions have been issued for the preparation of plans for a bank and office building to be erected on this site. While it is freely reported that constructional operations will be started early in the new year, no confirmation of this rumor can be obtained from the Van-

couver officials of the bank who are averse to supplying any further information on the subject for the present.

The Vancouver architectural firm of Doctor, Stewart & Davie, is engaged in the preparation of plans for a five-storey warehouse and storage building to be located in the C. P. R. reserve. The building will occupy a lot with an area of 45 x 100 feet, and will be of brick and mill construction, with concrete for the foundations and ground floor. The general equipment will include two steel rolling doors and a freight elevator. It is understood that contract tenders will not be called for until about the end of January.

Plans were recently completed by Mr. W. F. Gardiner for a proposed store and rooms building to be erected for Mr. C. M. Bowman at the corner of Main and Broadway streets, Vancouver. The structure will measure 100 x 100 feet, and will be two-storeys in height with part basement. The exterior construction will consist of face brick with trimmings of Monarch art stone. On the ground floor there will be five stores and a 40-foot frontage space devoted to the use of a proposed moving picture theatre. The first storey will contain 45 rooms and offices equipped with the usual modern facilities. It is expected that construction work on this building will be inaugurated immediately.

Large Hospital Expenditure

During the third week in December the local firm of Booker, Campbell and Whipple was awarded the general contract for the proposed reinforced concrete and brick Nurses' Home and central wing additions to the Vancouver General Hospital, the figures of the successful tenderers being \$199,921. So far as possible it has been decided to use home-manufactured products and local labor in connection with this contract. The hospital board announces that work will be undertaken and construction carried on without delay as the necessary funds are now available. The provincial authorities have been asked for an additional grant of \$250,000 to apply on the hospital. It is believed that the total work planned in connection with the new addition will represent an outlay of approximately \$800,000.

Mr. Thomas Hooper, a Vancouver architect, has been commissioned to prepare plans and detail drawings for the proposed factory buildings, warehouse and office accommodations, and a wharf for the Royal Crown Soap Company, of Vancouver, to be constructed on the foreshore of Burrard Inlet, near East Vancouver Heights. The plans for the wharf, it is expected, will be ready for contractors to figure on about the middle of January, and it is believed that tenders may be invited for the factory buildings about February 1. While no definite amount has been stipulated, it is understood that the total work will aggregate in cost about \$250,000. The company owns a site embracing seven acres.

Plans are being prepared by Mr. R. A. Nicolais for a modern apartment building which is to be erected at the corner of Fifth avenue and Pine street, Vancouver, for Mr. E. French of this city. The structure will be planned with two wings each two storeys high and having a street frontage of 50 feet with a large court in the centre. The construction will consist of frame and brick veneer. Both floors of each building will contain nine apartments, which are to be equipped with disappearing beds and other up-to-date con-

veniences. The cost of the work has been estimated at about \$20,000. No tenders will be taken at present.

The Vancouver-Prince Rupert Meat Company has decided to establish a modern cold storage warehouse on Water street, Vancouver, construction of which will be undertaken immediately following the completion of the plans. At present writing the officials have not decided as to whether the proposed building will be of reinforced concrete or brick and mill construction. The plans are to be prepared by the company's draughting department.

Mr. Emil Guenther, a Vancouver architect, has been commissioned by the building committee of the Fraternal Order of Eagles to prepare plans and specifications for the erection of their proposed lodge hall and building on Homer street, Vancouver, between Dunsmuir and Pender streets. The new structure will consist of three storeys and part basement, the ground measurements being 50 x 120 feet. The ground floor will be utilized for stores, and the second floor will be occupied by offices in front, with cloak rooms and a large dining room in the rear. On the top floor will be located one large and one small lodge hall with the usual accessories. It is understood that tenders for this building will be called for during January.

A permit for a two-storey and basement, brick and mill construction building to be erected at 155 Alexander street, Vancouver, for Mr. E. Cook was issued at the middle of December. This building will be used for store and office purposes, and will probably be erected by day labor. W. M. Dodd & Son, Vancouver, were the architects.

The Dominion authorities recently made an appropriation of \$15,000 to be utilized in building retaining walls and doing other permanent work in connection with the two lighthouse stations which are located in Stanley Park, Vancouver. All work will be carried out under the supervision of the Vancouver Park Board.

Messrs. Sharpe & Thompson, the Vancouver firm of architects which is engaged in preparing detail plans and specifications for the proposed British Columbia University buildings at Point Grey, near Vancouver, has awarded a contract to Dixon Bros. & Shultz for clearing the site for the University, which comprises an area of about 160 acres. In a recent statement from Victoria, Hon. Dr. Young, provincial minister of education, announced that actual construction on the various buildings would probably be inaugurated immediately after the land was cleared. A preliminary appropriation of \$500,000 is available for the construction work, which it is expected will ultimately represent an expenditure of several millions of dollars.

It is believed that a large number of tenders will be submitted from all over Canada for the construction of the proposed immigration buildings at the foot of Salisbury Drive, Vancouver, for which tenders closed on December 29. These buildings will be of heavy reinforced concrete and brick construction, costing about \$300,000 and will be erected by the Dominion government.

Messrs. Dalton & Eveleigh, of Vancouver, are engaged in the preparation of plans for a proposed reinforced concrete warehouse to be erected for Cope & Son, a Vancouver firm of electrical contractors. While there are no building details available for publication, it is understood that the warehouse will be a substantial fireproof structure of the latest type, costing about \$100,000.

Work started at the close of the year on the reconstruction of the seven-storey annex to the wholesale warehouse of Kelly Douglas & Company, Vancouver, which was recently practically destroyed by fire. The original plans of the structure will be utilized in connection with the present contract, which is in the hands of Mr. J. McLuckie, Vancouver. The new building will be of mill construction, and is estimated to cost approximately \$40,000.

The proposed new fish packing and cold storage plant to be erected at Steveston (Lulu Island) for the B. C. Packers' Association of New Westminster, will be housed in a heavy mill construction building resting on concrete and pile foundations. Plans and specifications were prepared by the Linde Refrigeration Company, and the general contract recently awarded to the B. C. Granitoid Company, both of these firms hailing from Vancouver. There will be two other contracts awarded in connection with the project, one for the electrical work and another for the special machinery equipment required for a complete fish canning and cold storage plant. The capacity of the plant will be about five million pounds in the cold storage department. The total cost of construction has been estimated at approximately \$200,000.

A permit was recently issued to Mr. W. Philpot for the construction of an ice-making plant on Carnarvon street, New Westminster. The factory will measure 33 x 64 feet, and will be of frame construction with galvanized iron sides and rubberoid roof. The equipment to be installed includes a 30-ton refrigerating machine, which will represent an outlay exclusive of the building, of \$10,000. It is expected that active construction will be commenced before the end of January.

The Morrison Steel Wire Company, whose present factory is situated in Vancouver, recently secured a site of about 16 acres on Lulu Island, about 8 miles from the city, and announce that a factory will be erected there and the company's business transferred to the new location within the next few months.

The general contract for the construction of a two-storey brick and mill hotel building for Mr. H. C. Thornton at Port Coquitlam has recently been awarded to Mr. W. H. Mueller of Vancouver. Parr, McKenzie & Day of Vancouver, are the architects for the building, which will be entirely modern and excellently equipped throughout.

The New Sanitorium at Kamloops

It is expected that work will be started early in January on the proposed sanitorium building at Tranquilla, near Kamloops, for the B. C. Anti-Tuberculosis Society, for which plans have been prepared by Dalton & Eveleigh, of Vancouver. The building will be of reinforced concrete on concrete foundations, with sand and lime plastering. The floor of the entrance hall will be finished in terrazzo tile. Steam heating and electric lighting will be employed throughout. The equipment of the building includes galvanized iron metal work, and skylights, a telephone system and fire extinguishers.

Work was started recently on the new Enderby Armory, for which the general contractor is Mr. J. Russell, a local builder. The building will measure 42 x 93 feet, and will have a solid concrete basement and two upper storeys of brick construction. The basement will contain a 60-foot shooting gallery and furnace room. The main hall measures 40 x 60 feet by 16 feet high, with truss roof covered with galvanized iron shingles. In the rear of the main hall will be six rooms, each measuring 14 x 24 feet for officers' quarters, two armories and a store room, all floors to be solid concrete, covered with No. 1, 1 x 3 flooring. There will be one furnace in the basement, and two in the main hall, and for fire protection, two hydrants, each with a 50-foot length of hose attached, will be placed in convenient positions. The cost of the building will be between fifteen and sixteen thousand dollars.

It is the intention of the Nelson City council to shortly submit a by-law to the ratepayers for an additional \$20,000 to be used for the construction of the proposed new Nelson Hospital. The provincial government will also be asked for a grant of \$50,000, which if supplied, will provide a total of \$90,000 for construction purposes.

Messrs. H. P. Leake and W. A. Calder were recently

awarded the contract for a new wharf which the Dominion government is erecting at Kaslo, B.C., at a cost of \$135,000.

The ratepayers of Nelson recently endorsed a by-law for the purchase of the street railway system which has been operated for a number of years past by a private company, thus again demonstrating their support of the principle of municipal ownership. The city now owns its own waterworks system, a 3,000 h.p. hydro-electric plant, and recently purchased the gas plant, which had been operated as a private enterprise for the past ten years.

Subject to revision by the 1914 council, the following work is provided for in a by-law to be submitted to the ratepayers of Vancouver in January, 1914: Grading for sidewalks, \$50,000; grading streets, \$110,000; grading lanes, \$26,000; culverts and bulkheads, \$10,000; rocking streets, \$96,000; planking streets, \$47,000; rocking lanes, \$41,000; planking lanes, \$30,000.

The Prince Rupert city council has given first reading to by-laws for municipal works to be voted upon at the coming civic election. The amounts provided are as follows: Telephone extension, \$70,000; permanent building, Fulton street, \$50,000; recreation grounds, \$30,000; extension of electric light plant, \$45,000; new electric light plant, \$105,000; municipal waterworks extension; agreement with Prince Rupert Hydro-electric Company.

Following the recent announcement of Mr. H. H. Stevens, M.P. for the city of Vancouver, to the effect that Dominion Public Works Department, is now working on plans involving the construction of extensive harbor works at Kitsilano Reserve, comes the news that the Vancouver civic officials are contemplating the erection of a bridge spanning False Creek from the reserve to the foot of Burrard street on the opposite side. While the scheme is as yet in tentative form it is recalled that the city has had this project in view for the past two years, and there appears to be every likelihood that the question of a bridge at this point will be seriously considered in the near future. With reference to the Kitsilano project, the only information that is available at present is contained in the statement by Mr. Stevens that the work will be on a large scale involving an expenditure of millions of dollars, embracing railroad trackage, warehouses, docks, etc., and probably necessitating additional dredging operations at the mouth of False Creek. It is expected that an appropriation bill in connection with the scheme will be presented at the next session of the federal parliament.

The annual report of Municipal Engineer Clement, of South Vancouver (who has recently tendered his resignation), shows that the following work was carried out during the year 1913: Streets cleared and rough grades, 3,235 miles; streets graded and bulkheaded, 12,297 miles; streets macadamized, 2.98 miles; streets permanently paved, 3.841 miles; streets oiled, 15.428 miles; plank roadway laid, 4.302 miles; box drains laid, 3.203 miles; walks laid, 9.127 miles.

Plans for the proposed Canadian Northern Pacific Railway bridge to be erected across the Victoria Arm from the Gorge Road to Songhees Reserve, at Victoria, have been filed with the Dominion government authorities for approval. The company's plan shows the location of the proposed bridge at about 200 feet above Dead Man's Island, with a 60-foot bridge bascule type, spanning the channel west of the Island, and a 25-foot opening adjoining the main span. The fill would run 1,110 feet in a southerly direction from the Gorge Bridge, the balance of construction to be of ordinary pile trestles with bents fifteen feet apart.

In the Supreme Court at Vancouver, Judge Grant recently handed down an important judgment effecting sub-contractors' claims under the mechanics' lien act. His Honor's finding makes it feasible for any sub-contractor who has paid up all his workmen and all his bills for material, to make and maintain successfully a claim against the owners of

the building, works or improvements undertaken for the amount due him under the mechanics' lien act.

The city council of Vancouver, at a special session recently authorized a by-law providing \$14,000 for the erection next year of a fire hall at some point in Hastings Townsite yet to be selected. Of this amount \$10,000 will probably be spent for the building, and \$2,000 for the site.

It is considered unlikely that there will be any new school construction undertaken by the Vancouver school board during 1914. Aside from the amounts which will be required for the purpose of making a few small additions to existing buildings the members have decided to submit no money by-laws for the coming year excepting those covering regular expenses.

Contract Let For New Drill Hall at Victoria

Advices from Victoria state that the Dominion Department of Public Works has awarded the contract for Victoria's new drill hall to Parfitt Bros., of Victoria, who intend to commence constructional operations before the end of January. The building is to be of red brick faced with cut stone and battlemented, and will be erected on a site bounded by McBride street, Bay street and Field street, with the main entrance on Bay. This entrance will be in the form of a handsome gateway under a square tower, in the centre of the building. The main hall will be spacious affair, measuring 100 x 200 feet.

In the tower, accommodation will be provided for bands, and on either side of the entrance are rooms for the commanding officers and adjutants of two regiments, and in the left wing similar rooms for the officers of a third regiment. On the right front is a room for the British Campaigners, and at the rear of the hall offices for the brigadier and his adjutant. Armories, gunsheds and stores occupy the remainder of the ground floor, while underneath in the basement is the ambulance store, access to which is gained by an inclined roadway. In the basement, too, is the regimental swimming bath.

On the second floor are the four officers' messes and kitchens, sergeants' messes and reading rooms for the men, and above these again three suites for caretakers, comprising four bedrooms, sitting room and kitchen.

The contract calls for the completion of the whole building within eighteen months. Major W. Ridgway Wilson, of Victoria, prepared the plans for the new drill hall which it is understood, will be the second largest in Canada, being exceeded in size by only one other building of this type, namely that at St. Johns, N.B. The cost of the work will be approximately \$240,000.

Victoria's Good Prospects

Commencing operations at the middle of January, the seating capacity of the Princess Theatre in Victoria will be enlarged from 600 to 1,000 the work practically involving the reconstruction of the entire building. The house will be closed for a period of two months during which the back, front and east side walls are to be demolished and the structure transformed into an up-to-date theatre at a cost of approximately \$35,000.

Tenders covering the separate contracts required in the erection of the new store building for the Hudson's Bay Company at Victoria closed on December 27. The plans provide for a ten-storey structure, but it is intended to erect only four storeys at the present time. The amount available for construction work is \$450,000.

Messrs. Coates & Fleet, recently completed plans for extensive alterations to the Brown Jug Saloon in Victoria, which will transform the present quarters into a modern hotel. The ground floor of the altered premises will be occupied by the buffet, dining room, office and other departments, and the two upper floors will accommodate over 30 rooms fitted up in attractive style. It is intended to install a

complete system of steam heating. The Victoria firm of Metzger & Weston will handle the general contract, which is valued at approximately \$25,000.

Tenders closed at Ottawa on January 8 for the construction of two reinforced concrete piers with a solid fill in Victoria harbor, for which the Dominion Department of Public Works has made a preliminary appropriation of \$500,000. The ultimate expenditure on the piers, of which there will eventually be four, will be \$750,000 each. It is understood that a number of the large construction companies throughout Canada have submitted tenders for the contract.

It is understood that McCutcheon Bros., realty dealers of Victoria, have purchased the premises at 844 Fort street, where it is their intention to erect a store and office block in the near future. The lot occupies a street frontage of 60 feet, and cost \$60,000.

Credence is being given a report circulating at the Coast that the Dominion government will probably make provision in next year's estimates for the construction of a new court house in Victoria. A triangular block, comprising an area of two-thirds of an acre, and bounded by Blanchard and Collinson and Burdette streets, which was recently purchased by the authorities, is reported as the proposed site of the new building.

A two-storey frame apartment block with accommodation for 36 rooms will shortly be erected for Mr. F. Fairhurst on the corner of Queens avenue and Vancouver street, Victoria, at a cost of about \$20,000.

Within the near future the Dominion government will call for tenders for the execution of extensive improvements on the Victoria post office block. The plans, which were prepared some time ago, have been revised, and it is reported that they are on the point of completion. It has been announced that the new plans provide for two extra storeys at the rear of the present building, instead of one, as was originally proposed.

The Victoria city council recently adopted a resolution to the effect that the debentures authorized under the \$80,000 by-law passed last January for the erection of a new jail be issued and placed on the market at once, and that plans and specifications be prepared and tenders called for the new structure forthwith.

The annual meeting of the Canadian Society of Civil Engineers will be held at Montreal January 27, 28 and 29.

"The Engineer's Part in the Regulation of Public Utilities" was the subject of a discussion at the Stevens Institute of Technology, Hoboken, N.Y., on January 9.

During the year just closed, three-quarters of a million dollars have been expended on the roads of Ontario. The year's work on highways improvement shows 220 miles of highway added to the transportation facilities. The style of road is macadam and gravel, of a type which is giving satisfaction to the Provincial Highway Engineer, Mr. W. A. McLean. The share borne by the government in the construction and supervision of the work is one-third.

The Concrete Machinery Company, Limited, is to be the new firm name of an amalgamation of the Woodstock Wind Motor Company and the Mitchel Crusher Manufacturing Company, the latter of which is a selling organization for stone-crushing machinery, with headquarters in Toronto. A by-law upon which the ratepayers of Woodstock are asked to vote provides for the loan of \$20,000 to the Concrete Machinery Company. As security the company is to give the corporation of Woodstock a first mortgage on all its real estate, building and machinery.

Personal Mention

Mr. J. C. Stewart has received an appointment as manager of the Toronto Wire Nail & Tack Company, West Toronto.

Mr. A. R. Woolridge, manager of the scale department of the Canadian Fairbank Morse Company, Toronto, has left for a short holiday at his Texas home.

Mr. C. J. Simms, assistant engineer of the Saskatchewan division of the Canadian Pacific Railway, has been transferred to Vancouver to succeed Mr. H. B. Walkem as assistant division engineer.

Mr. G. Janin, chief engineer of the city of Montreal, has withdrawn his application for a pension of three-quarters of his salary. A bill to grant this higher pension was introduced into the Quebec Legislature.

Mr. H. V. Armstrong has returned to Estevan, Sask., as town engineer. A graduate in civil engineering of Toronto University, Mr. Armstrong spent over four years in Estevan supervising the new water supply and sewage disposal system, etc.

Mr. W. A. Clement, of South Vancouver, B.C., has been appointed chief engineer for the district of South Vancouver, and will have charge of pavement, road and drainage construction. Mr. Clement was assistant city engineer of Toronto from 1898 to 1905, and city engineer of Vancouver from 1905 to 1911.

Mr. I. Feldman, architect, who was associated for some time with Mr. J. P. Hynes, 199 Yonge Street, Toronto, has opened an office at 44 Adelaide West. Mr. Feldman has several projects already in hand, including the Collett Sproule factory on Portland Street, and the Rotenburg warehouse on Elizabeth Street.

Mr. H. B. Walkem, for five years Assistant Divisional Engineer of the Canadian Pacific Railway at Vancouver, has been appointed engineer in charge of the Kootenay and Boundary districts of that road, with headquarters at Nelson, B.C. Mr. Walkem has had thirty years' experience in railroad engineering in the Pacific province.

Mr. Charles P. Dubuc, B.A.Sc., in conjunction with his brother, has commenced business as a consulting engineer, under the firm name of Dubuc & Dubuc, in the Canadian Express Building, Montreal. Mr. C. P. Dubuc has been connected with municipal works in St. Louis, Cote St. Paul and Maisonneuve. He has also had experience in hydrographic work and good roads promotion.

Mr. Beaudry Leman has been appointed general manager of the Hochelaga Bank, Montreal. Mr. Leman is a civil and electrical engineer and at one time was a member of the Montreal Electrical Service Commission. In 1906 he was in charge of the construction work of the Shawinigan Water and Power Company, and later organized the Canadian General Development Company, which was interested in electrical enterprises. In 1912 he entered the banking business.

Mr. Reginald W. Brock, director of the Geological Survey of Canada, has been appointed Deputy Minister of Mines in succession to Dr. A. P. Low, retired. Mr. Brock was born in Perth, Ont., in 1874, and was educated at the Ottawa Collegiate Institute and Toronto, Queen's and Heidelberg. As a professor at the Queen's School of Mines before joining the staff of the Geological Survey he carried out many important explorations and is regarded as one of the best geological authorities in Canada. He has been Director of the Survey since 1904.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The building permits taken out at Brantford, Ont., during 1913 totalled in value \$1,015,886, a decrease of \$151,219 on the previous year's total.

Mr. J. T. Blyth, heating and sanitary engineer, has secured the contract for the plumbing and heating work in a number of new buildings in Ottawa, including the Blackburn Building and St. Luke's Hospital.

Notwithstanding the much-talked-of hard times, the building permits issued in Fort William show an increase of over a quarter of a million dollars, the respective figures being: 1913, \$4,029,965, and 1912—\$3,746,565.

Gypsum is regarded as one of the leading industries from the point of view of exports in Hunt's County, N.S. Last year the total exports amounted to 260,000 tons, but this year the total will reach fully 300,000 tons.

As previously announced in these columns, Messrs. Roger Miller & Sons are the contractors for the laying of about 4,000 feet of pipe, including tunnel and reservoir connection, tanks, etc., on Toronto Island. The work is progressing rapidly.

According to the city architect plans were endorsed in Toronto during 1913 for 9,877 buildings at an estimated cost of \$26,962,654, as against 10,217 buildings at a cost of \$27,401,761 for which permits were issued in 1912, the latter being a record year.

It is announced that the contract for the new factory for the Canada Nail & Wire Company, which is to be located at Cold brook, about three miles from St. John, N.B., will be awarded as soon as the company has received its charter. The construction will probably be of brick.

Returns issued from Port Arthur show that for the past year the amount of building done in that city is valued at \$1,935,680, as compared with \$2,494,179 in 1912. Explanation of this decrease is that the permit for the new government elevator, which cost a million and a half dollars, was issued in December, 1912.

Welland has just emerged from a year of great prosperity in building construction. It is stated that two miles of brick pavement, half a mile of slag and macadam pavement, one and one-half miles of sewers and four and one-half miles of cement sidewalks have been laid, the total building for the year 1913 amounting to \$1,061,157.

Plans are being prepared at Windsor, N.S., for a modern mill, with a capacity of 250 barrels a day, for the manufacture of plaster products. The company, with a directorate consisting of Messrs. Rufus Curris, of Windsor; Hon. A. K. MacLean, M.P., T. F. Courtney, Gerald B. Ternan, and F. C. Smythe, all of Halifax, was formed last year and it is anticipated that the new mill will be ready for work next summer.

The firm of McAvity & Sons, Limited, St. John, N.B., are contemplating the erection of an extensive range of buildings to consist of a warehouse, iron and brass machine shops, power house, foundries and administration building. All the buildings are to be of steel and brick, with concrete foundations. When completed the proposed plant is expected to furnish employment to twelve or fifteen hundred people.

It is expected that tenders will be called early this year for the greater part of the work.

During 1913, 287 permits were issued by the Building Inspector's Department at Welland. These were of the total value of \$611,157; \$398,455 representing 237 permits were for residences, and \$212,702 representing 50 permits, were for business and public buildings. In addition to this \$350,000 for industries and \$100,000 for residences was spent on the industrial section outside the town limits, the total for the year being \$1,061,157.

According to a Fort William despatch, the stocks of cement available at that point are much lower than at the corresponding period a year ago. If last year's activity in building operations is repeated this year it is feared that there will be a shortage of cement in the spring. It is stated that owing to the loss occasioned by the big storm on the lake in November, when thousands of sacks of cement were lost, manufacturers were deterred from shipping any more cargoes until the spring.

The Sherbrooke Tile & Brick Company has been incorporated with a capital stock of \$75,000. Its head office will be in Sherbrooke, Que., and the business to be carried on will include the manufacture of brick, tile and clay products of all kinds. The promoters are Messrs. N. N. Walley, C. Beauchesne, N. E. Walley, Chas. B. Howard and J. MacDonald, of Sherbrooke, and E. L. Darche, of Ascot Corner. The new company has purchased the Ascot Brick plant, owned and operated for many years by D. G. Loomis & Sons.

The building permits issued in St. John, N.B., last year amounted to nearly \$2,500,000, or about \$2,000,000 more than the value for 1912. Work on some of the large contracts begun last year will be continued in 1914, and the prospects for new building projects are considered bright, for the reason that greater housing accommodation must be provided for the people. Mr. D. F. Pidgeon, who has lately returned from a trip to Great Britain, brought the information that the organization of a large building company to erect dwellings in St. John and its neighbourhood is making good progress. It is known that local companies will also take a hand in construction work, and therefore 1914 should prove a good building year in St. John.

WESTERN CANADA

New Westminster's building permits for 1913 amounted to \$958,975, as compared with \$1,634,518 in 1912 and \$1,124,587 in 1911.

The new Government wharf at Argenta on the Kootenay Lakes is rapidly nearing completion. The docks are of a new type of construction and an innovation in British Columbia.

Last year the building permits issued at Prince Albert, Sask., amounted in value to \$1,380,290, as compared with \$2,042,450 for 1912. The figures are from Mr. H. L. Fitzsimons, Building Inspector.

Mr. J. S. MacLachlan, Dominion District Engineer, has returned from a tour of inspection of the harbor works in the Nanaimo district, B.C., during which he investigated the dam

age done by the recent heavy gales. He found that repairs were necessary at Sydney Island where the wharf had been considerably damaged. Repairs will also be necessary at Sydney, Metchosin and Rocky Point.

Work on the Government docks on the Arrow Lakes is progressing rapidly. This work includes new docks at West Damars, East Arrow Park, Needles and Renata, all of which are floating docks.

According to figures furnished by Mr. O. T. Falls, building inspector at Regina, the permits issued in that city last year amounted in value to \$4,018,350. This compares unfavorably with the 1912 total of \$8,047,309.

The aggregate value of buildings started and for the most part completed in Saskatoon during the year 1913 was \$2,633,845. The greatest number of permits issued and value of buildings planned was in the month of May, the falling off taking place since August.

The city of Medicine Hat has established a record in the number of building permits issued during the year. The building inspector, Mr. Daley, reports that permits have been taken out for buildings valued at \$3,851,572, an increase of \$1,015,353 over that of 1912, or over 40 per cent.

One of the most important civic buildings to be erected this year is the Central Police and Fire Station, at the corner of Elizabeth and Fraser Avenue, Edmonton, Alta., at an approximate cost of \$350,000. The plans and specifications were prepared in the office of the City Architect, Mr. A. M. Jeffers. The new building will be constructed of pressed brick with stone trimmings. About two-thirds of the structure will be occupied by the police department.

A decision that will interest architects was given on January 1 at Regina, by Mr. Justice Elwood, when the claim of Messrs. Munro & Mead, architects, against the Yorktown Agricultural & Industrial Association, Limited, for service in preparing plans for a grand stand was allowed. The plaintiffs had prepared two sets of plans, the stand to cost not more than \$14,000, but tenders were considerably higher on both occasions and the defendants decided not to proceed on the work, declining to pay for the plans. Plaintiffs were awarded \$680, made up of \$490 for the first set of plans, \$180 for the second set and \$10 for taking out the permit.

A remarkable suspension bridge has been erected by the Indians in British Columbia, across the Bulkley River, Prince Rupert. A feature of the bridge is the almost total absence of nails. Joints were made by dove-tailing and burning a hole with red hot coals through the two logs into which a stout wooden spike was driven, the joints being then bound with wire. The big cable supporting the structure was obtained from the Hudson's Bay Company, who used it on the first steam boat which travelled up the stream.

Obituary

Mr. Benjamin Goldthorpe, a former Toronto contractor, passed away recently at Hamilton.

Mr. James Steele, president of the James Steele Wire Works, Limited, Guelph, Ont., died on December 30.

Mr. Alfred Williams, formerly associated with Mr. M. J. Haney in the construction of the White Pass and the Cooper River and North Western railroads, died recently.

Mr. Lockie McQuarrie, of New Westminster, one of the best known contractors and financiers in British Columbia, died recently at San Diego, Cal., at the age of eighty years. The late Mr. McQuarrie was the pioneer road contractor of the province, having carried out several contracts on the Canadian Pacific Railway main line and constructed the first twenty-five miles of the Great Northern Railway at New Westminster.

Canadian Railroad Development

Mr. B. B. Allither, Chief Engineer of the Grand Trunk Pacific, announced recently that the line would be completed next April at a point about a hundred miles west of Fort George, B.C.

Mr. A. R. Gould, president of the St. John Valley Railway, recently secured a charter for a railway across the northern part of the state of Maine, connecting the existing lines in Quebec and New Brunswick.

The Lake Erie & Northern Railway is seeking power to increase its issue of securities, from \$30,000 to \$45,000 a mile and to borrow money and issue securities for the acquisition, construction and extension or development of any properties or works other than railway.

Sir Wm. McKenzie, president of the Canadian Northern Railroad, announced recently that the company had decided upon an expenditure of about \$10,000,000 in securing additional rolling stock for the operation of this road. It is stated that practically the entire amount will be laid out between Toronto and Port Arthur. Sir William further stated that as a result of the opening of the new transcontinental line, Leaside will become one of the largest repair shops on the road.

As part of the Canadian Northern Railway extension in Nova Scotia it is said to be the intention of the company to establish a junction at a point convenient to Sydney and Louisburg, with pier terminals at both places. Sydney will be the summer terminal and Louisburg the winter terminal of the Canadian Northern, with a transcontinental branch running from the strait to Moncton along the Northumberland short route to Moncton, and thence west by the best available route.

A report from Sydney, N.S., states that Messrs. Mackenzie and Mann, who own the Inverness railway, will negotiate for a right-of-way from St. Peter's to Sydney, a plan which includes the taking over of the Vanderbilt-Webb line, Point Tupper to St. Peter's, and the extension from St. Peter's to Sydney and St. Peter's to Louisburg, by way of the South Cape Breton route. It is understood that the Canadian Northern is willing to commence the work as soon as the right-of-way can be secured and the construction financed.

Sir Wm. McKenzie, president of the Canadian Northern Railway, drove the last spike of the new line connecting the eastern and the middle western provinces of Canada near Little White Otter river, at a point 254 miles east of Port Arthur, 616 northwest of Toronto and about 60 miles north of White River station, on January 1. This gives the country its second cross-continent line from Quebec to British Columbia. This new section of the line when fully completed will be remarkable for the rapidity of its construction and for its efficiency. The contract was awarded to Messrs. Jones Bros. and the Northern Construction Company in the summer of 1911. Mr. H. K. Wicksteed was chief locating engineer.

Construction work on the Edmonton & Dunvegan Railway is making satisfactory progress. The first one hundred and thirty miles will be over that portion already constructed which brings the end of steel to Smith and the south bank of the Athabasca river. Grading on the new line has been done to mile 220 and surveys are completed for 210 miles. Extensive orders for rolling stock were placed some time ago with the Canada Car Company, of Montreal, including eight locomotives, one hundred box cars and fifty flat cars. Mr. W. J. Pace the newly-appointed superintendent of construction for both roads, is well known in Edmonton as a pioneer in railway work into that city and as a commissioner of public works.

Souvenir of Royal Visit to Pilkington Plant

In July of last year Their Majesties the King and Queen, while touring the northern industrial district of England, paid a visit to the great glass works of Messrs. Pilkington Brothers at St. Helens, Lancashire, and an interesting souvenir booklet has been issued by the firm as a memento of the occasion. By those who wish to know something about glass manufacture this publication will be found particularly instructive. The illustrations carry one through the principal departments of the largest glass-manufacturing establishment in the world—an industry whose products have found their way into every country. It may be of interest to note that the business was founded in a small way in 1826 by Richard and William Pilkington and that at present three generations of the family are actively engaged in the management. The firm have made an aggressive bid for Canadian business, having established warehouses at Montreal, Toronto, Winnipeg, Calgary and Vancouver, and built a factory at Thorold, Ont.

Brownhoist Hand-Travelling Cranes

Illustrated herewith is the Brownhoist Single I-Beam Hand-Travelling Crane manufactured by the Brown Hoisting Machine Company, Cleveland.

The construction of this crane permits it to be used in very limited head-room. The crane consists of a single I-

are no undue strains put upon any member and the load is distributed equally of the two truck wheels. The I-beam rests on two planed surfaces at the centre of the truck-frame. It is bolted to the truck-frame at the top (Fig. 2) and is also held in place by a dowel on the truck-frame which fits into a small recess on the underside of the bottom flange of the I-beam. By means of this simple construction, the crane is erected easily and quickly, even in close quarters.

The truck-frame is supported on two truck wheels with a bearing on each side of the wheel. The two bearings with the axle and wheel are secured to the truck-frame by means of U-bolts. The cranes of $\frac{1}{4}$ to 1-ton capacity inclusive are fitted with bronze bushings which are scored to give the proper lubrication to the bearings. The larger size cranes, above 1-ton capacity, are bushed with steel roller-bearings. These reduce to a minimum the wear on the axle and make the operation of the crane very much easier. By having a bearing on both sides, the wheel is kept in an erect position, regardless of any wheel-flange side pressure. It permits small diameter axles to be used, which results in a very low frictional resistance when the crane is travelling. Also it distributes evenly the wear on the bearings. Each crane is equipped with a squaring shaft connecting one wheel of each truck (seen Fig. 1). This insures uniform travel of both end truck-frames. All standard cranes of $\frac{1}{4}$ to 1-ton capacity inclusive, with spans not exceeding 20 ft., have no travelling mechanism. These cranes are easily propelled along



Fig. 1—Brownhoist single I-beam hand-travelling crane with patented cast-steel ends, equipped with a Brownhoist trolley and a Yale & Towne triplex chain block.

beam supported at each end on a Brownhoist patented truck-frame of cast steel. The I-beam is of standard size, sufficient for the required capacity and span. The lower flange of the I-beam serves as a track for the trolley with the load, as shown in Fig. 1. The patent truck-frame (Fig. 2) is a one-piece steel casting of light construction but with ample strength for the crane capacity. It is so designed that there

the track by pushing or pulling on the load. The larger capacity cranes are equipped with hand travelling chain and sprocket wheel (Fig. 1). By pulling on the hand-chain, the crane is propelled along the runway. The largest capacity cranes are fitted with travelling reducing gears which reduce the amount of pull required on the hand-travelling chain necessary to travel the crane.



Fig. 2—Brownhoist patented cast-steel end.

A joint conference of representatives of the City Council, Board of Trade, Harbor and Navigation Committee and Inner Harbor Association, met in Victoria, B.C., recently to examine the plans for the proposed Canadian Northern bridge across Selkirk water. The feeling was against a temporary structure being allowed, and that in any event a pile or trestle structure should not be allowed to be used more than three years. Messrs. J. S. MacLachlan, Dominion Resident Engineer, and D. O. Lewis, District Engineer of the province, were among those present.

Late News and Industrial Notes

Messrs. M. D. Seaman & Son, Sauble Falls, Ont., intend going into the manufacturing of sand-lime brick, the timber on their limits being practically exhausted.

The publicity commissioner of Fredericton, N.B., states that two new mills will be erected there in the spring, and that several other concerns will enlarge their plant.

Work on the construction of the new British Columbia offices in London, Eng., has been commenced by the contractors, Messrs. Hannin & Cubit. The site, which is on Regent street, is Crown property and the total cost of construction will approach \$300,000.

The Burrard Inlet Tunnel & Bridge Company, in order to facilitate matters in connection with the Second Narrows Bridge, B.C., will call for tenders for the new bridge on plans prepared by Sir John Wolf Barry and his associates, tenders to be in by April 1.

Mr. A. E. Allison, one of Winnipeg's old-timers, is at present engaged at Indian Bay, Lake of the Woods, in building temporary camps for the Greater Winnipeg water project. Mr. Allison is one of the oldest railway and building contractors in the west, he having been engaged in that work since 1877.

Various kinds of elevated steel tanks built for municipal service are described in an informative, well-illustrated catalogue received from the Chicago Bridge & Iron Works, Chicago. The booklet is made additionally interesting by the tables which it contains and an outline of the proper method of finding stresses in the various parts of the structure.

Addressing the Vancouver Chapter of the British Columbia Society of Architects, Mr. H. H. Stevens, M.P., alluding to the powers possessed by the architects' profession said that in no other calling could a man do so much good for humanity and likewise in no other profession could he do so much harm if one allowed mercenary considerations to run away with his sense of right.

A report from Vancouver states that Mr. A. F. Yarrow, head of a great ship-building firm operating on the Clyde, has bought out the British Columbia Marine Company with the intention of establishing a branch of his yards at Esquimalt, for shipbuilding purposes. He is said to be influenced in deciding in favor of Esquimalt by the fact of the government drydock being located at Langs Cove.

Messrs. F. H. Hopkins & Company, Montreal, manufacturers of railway, contractors' and mining supplies, have favored us with one of their calendars for 1914. The numerals are in good plain type and the calendar is particularly valuable for office and warehouse purposes. We are also indebted to The B. Greening Wire Company, Limited, Hamilton, for a most serviceable calendar.

The record of buildings in Victoria for the past year has been satisfactory in view of the adverse financial conditions. The number of permits issued was 1,157, as compared with 1,763 the previous year. The total value for 1913 was \$3,766,230 apart from additions to the Parliament Buildings, Post Office, and a new theatre which totalled about a quarter of a million. The total value of permits issued in 1912 was \$8,060,170.

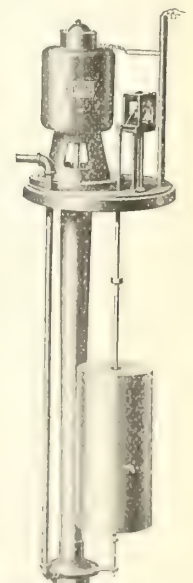
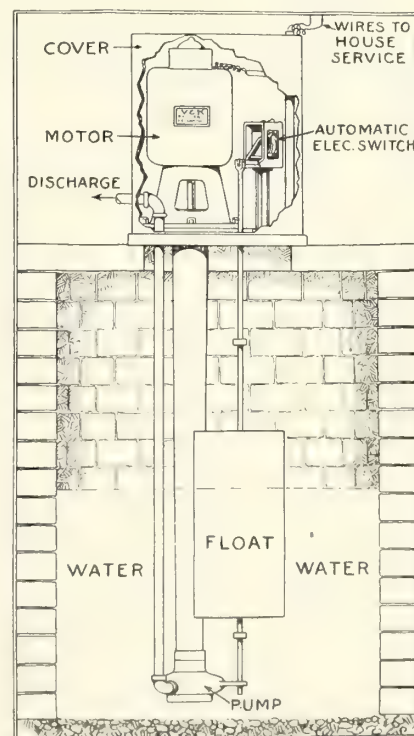
Addressing the British Columbia members of the Canadian Society of Civil Engineers at the second annual convention dinner in Victoria, Hon. W. R. Ross, Minister of Lands, referring to the natural resources of western Canada said the engineering fraternity bore an important relation to the development of these natural resources. Almost the entire success in many lines depended on the economics of engineering and he felt that the men of that profession knew

their responsibility and would rise to the occasion and do as well by British Columbia as nature had done by the province.

The St. John, N.B., city council has asked the Dominion Government to move back the railway trestle which now crosses the area, dredge out the basin, and construct two steamship berths, eight hundred feet in length, on the site adjoining the wharf of the new sugar refinery. The railway could be carried around the shore instead of crossing the basin on a trestle as at present, and the change would also involve the removal of some small factories, some fish-curing houses, a coal depot and other buildings. The Federal Government owns nearly all of the property involved, and the proposed two steamship berths are greatly needed on the eastern side of the harbour.

Automatic Electric Cellar Drainer

Those who are troubled with wet cellars or basements will appreciate the value of the automatic electric cellar drainer illustrated herewith. This device, it is claimed, is the first practical drainer of moderate price suitable for private residences, apartments, elevator pits, etc. As shown by the diagram it consists of a centrifugal pump direct connected to a vertical Westinghouse motor. The pump is installed in a three-foot well into which the seepage drains, the motor and control apparatus being at the floor level where it is accessible for inspection and is out of the way of dampness. A float plays between between two stops on a vertical rod that is connected with the motor control switch. When the water in the well rises sufficiently to cause the float to press against the upper stop, the motor is started and continues in operation until the water level is lowered so that the float presses



Motor-driven pump for draining purposes.

against the lower stop, when the current is cut off. The seepage is thus cut off without attention, an occasional inspection and lubrication being all that is required. This pump has a capacity of 500 gallons per hour against a head of 5 feet, and 150 gallons per hour against a head of 20 feet. To install it all that is necessary is to provide a well three feet deep, place the pump, and make the electrical connections. It operates from the electric lighting circuit.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Coteau Station, Que.

Tenders for laying cement sidewalks will be received by Secretary of Municipal Council, G. E. Andre, until noon, Jan. 19th.

Dereham Twp., Ont.

Surveys for a tile drain have been made by the engineer-in-charge, F. J. Ure, Woodstock.

Le Pas, Man.

The necessary by-law having been passed by the ratepayers, tenders will be received by Secretary to Town Council, H. H. Elliott, M.D., until 6 p.m. Feb. 3rd, for the construction of approximately 430 ft. of 16 in. supply intake main and 2 sewer outlets into the Saskatchewan River. Specifications and plans at office of Consulting Engineers, Murphy & Underwood, Saskatoon, or with Resident Engineer, Le Pas.

A by-law providing for the installation of waterworks system was passed by ratepayers Dec. 16th.

Kenora, Ont.

The by-law to raise \$22,000 for improvements to roads and \$3,000 for parks has been carried by the ratepayers. The council will probably purchase a steam road roller.

Lumby, B.C.

Municipal Council have under consideration the installation of a waterworks system and a committee of three (J. T. Bardolph, C. Quesnel and T. A. Norris) has been appointed to look into the matter. Water will probably be brought from Harris Creek.

Niagara Falls, Ont.

Plans are in progress for the laying of 3,000 ft. 24-in. storm sewer from Third Ave. to Victoria Street.

The by-law to raise \$5,000 for storm sewer on 3rd Ave. and Maple St., was carried by ratepayers Jan. 5th.

Norwich, Ont.

A by-law authorizing the expenditure of \$25,000 on the installation of a waterworks system was carried by the ratepayers on Jan. 5th.

Ottawa, Ont.

Plans have been drawn for asphalt pavement on Parent Ave. from Clarence St. to St. Andrew, tenders for which are to be called in spring. Estimated cost is \$8,000.

Surveys have been made for asphalt pavement on Wellington street between Holland Ave. and city limits. Estimated cost \$31,000.

Surface drainage having been completed, City Engineer, Arch. Currie has made surveys for asphalt pavement on Roches-

ter St., between Ellen St. and G. T. Rly. tracks, and between Somerset and Wellington Sts.; on St. Andrew St., between Cumberland and King Sts.; and on Church St., between King Edward Ave. and Rose St. In addition to this work plans have been made for asphalt pavement on Wellington St., between Broad and Viaduct Sts., the estimated cost is \$12,000.

Owen Sound, Ont.

The ratepayers defeated on Jan. 5th the by-law for roads improvements.

Peterboro, Ont.

Nothing further will be done with reference to the sewage disposal plant until after first meeting of new council to be held about the 12th inst. Chairman Board of Works, Wm. Buller. Engineer, R. H. Parsons.

Paisley, Ont.

The by-law to raise \$10,000 for extension to waterworks was defeated by the ratepayers.

Point Edward, Ont.

The by-law authorizing the raising of \$20,000 for the installation of watermains has been carried by ratepayers.

The Town Council has under consideration the laying of cement walks at an estimated cost of \$7,000.

Regina, Sask.

It is estimated that 920,000 sq. ft. of concrete sidewalks and 23,000,000 sq. yds. of pavement are to be laid this year. Engineer, F. McArthur has the plans in progress.

Toronto, Ont.

Tenders for the construction of sewers on Benson, Boon, Day, Earls court, Fir, Goodwood, Harvie, Hope, Ryerson, Sellers, Sparkhall and Wade streets and four lanes.

Tenders for street grading on Ardagh, Colina, Connelly, Hallawell, Minto, Mann and Spring streets, close Jan. 20th.

Tilbury, Ont.

The by-law to extend watermains 6,000 ft. has been carried by the ratepayers.

Whitby, Ont.

The by-law authorizing the expenditure of \$115,000 for installing a sewerage system was carried by the ratepayers on Jan. 5th.

Railroads, Bridges and Wharves

Esquimalt, B.C.

The Dom. Govt. Dept. of Public Works has purchased a site on Langs Cove for drydock purposes. Tenders will be called shortly.

Halkirk Twp., Ont.

The C. N. R. has been authorized to construct a bridge across Bears Pass,

Con. 3, Twp. Halkirk, Dist. Rainy River, Ont., mileage 210.6 from Port Arthur.

Halifax, N.S.

It is understood that the Government may build a dry dock similar to the one now under construction at Levis, Que.

London, Ont.

The C. P. R. has been authorized to reconstruct a bridge, No. 5, across Oxford street.

Montreal, Que.

Canadian Pacific Railway have under consideration alteration and additions to Osborne St. station; these include an underground baggage room. The estimated cost is \$1,000,000. Architect, Mr. Ellingwood, Windsor Station.

Mount Forest, Ont.

The by-law providing for the construction of a bridge over Maitland river to the mountain property has been passed by the ratepayers.

Niagara Falls, Ont.

The G. T. Rly. will probably construct a siding for the Standard Crushed Stone Co.

Sarnia, Ont.

Plans are in progress by the G. T. R. for reconstructing wharf. The work, which it is estimated will cost \$10,000, will be started in the spring under the superintendency of W. R. Davidson, London.

Sherbrooke, Que.

The C. P. Rly. has been authorized to construct bridge No. 7 across Wellington St.

Vancouver, B.C.

Tenders received by the Burrard Inlet Tunnel & Bridge Co., 142 Hastings St. W., Secretary, K. J. Cockrell, until noon, April 1st, for construction of bridge to connect city of Vancouver with municipality of North Vancouver by means of a single line of steam track, 2 lines of electric car track, 2 lines of roadway and a footway, together with the necessary approaches thereto, as well as the machinery for working the opening span of the bridge and other incidental works. Plans, specifications, etc., at offices of Consulting Engineers, Sir John Wolfe Barry, Lyster & Partners, 2 Queen Ann's Gate, Westminster, London, Eng., at office of company's agents, Messrs. Pringle & Guthrie, Citizen Bldg., Sparks St., Ottawa, after Jan. 19th, and at office of Engineers, Messrs. Cleveland & Cameron, after Jan. 26th.

CONTRACTS AWARDED

Kincardine, Ont.

The Dom. Govt. Dept. of Public Works has awarded the breakwater contract to General Contractor, Wm. Birmingham. \$130,082.

Oak Point, N.B.

The contract for dredging has been

awarded by the Public Works Department to Maritime Dredging & Constr. Co., Ltd., St. John, N.B.

Niagara Falls, Ont.

The contract for the parapet wall at Queen Victoria Park has been awarded to R. Secord, St. Catharines, at \$8.50 per foot.

Ottawa, Ont.

The Commrs. of the Transcontinental Rly. have awarded the contract for the delivery of 196,000 railway ties at Hervey Jct. and La Tuque, Que., to Ernest Gauthier, c/o P. E. Blondin, M.P., Grand Mere, Que.

Public Buildings, Churches, Schools, etc.

Durham, Ont.

A by-law authorizing the expenditure of \$15,000 for the erection of a High School was passed by the ratepayers on Jan. 5th. Council Clerk, Wm. B. Vollet.

Fort William, Ont.

The ratepayers defeated the by-law to raise \$10,000 for addition to the city hall.

Gananoque, Ont.

The proposed alterations to the town hall have been postponed for the present as tenders received were too high. Architect, B. Dillon, Brockville.

Guelph, Ont.

The city council has under consideration the erection of a municipal building at an estimated cost of \$11,000. Council Clerk, T. J. Moore.

Architect W. A. Mahoney has plans in progress for bank building on Macdonnell St. for the Merchants Bank. The estimated cost is \$10,000.

Hespeler, Ont.

A by-law authorizing the expenditure of \$25,000 on the erection of a town hall was carried by the ratepayers on Jan. 5th.

Hull, Que.

The French Protestant School Trustees are considering the erection of a solid brick school building. For further information address Sec. School Board.

Lakefield, Ont.

Jas. Bogue, 220 Dublin St., Peterboro, who has the contract for the post office, is receiving tenders for sub-contracts, to close in spring.

Lethbridge, Alta.

Tenders will be received by Sec. of Public Works Department until Jan. 29 for post office fittings. Specifications, etc., at Dept., Ottawa.

Milltown, N.B.

Tenders for public building planned by the Public Works Department have been received but no action will be taken at present.

Merritt, B.C.

Jas. Layfield, 1024 Broadway St. W., Vancouver, who has the contract for the court house is open to receive tenders for cement, lumber, plumbing, heating, painting, etc.

Montreal, Que.

Plans for the erection of a school and chapel of steel and brick construction

for the Parish of St. Mark, having been drawn, J. Bigonnesse, architect, 92 Notre Dame E., will call tenders for sub-contracts about Feb. 1st.

Montreal, Que. (Notre Dame de Grace)

Plans are in progress for the new fire station and G. A. Monette, architect, 260 St. James, expects to call tenders shortly. The specification calls for two stys., 110 x 50, concrete foundation, waterproofed, stone and brick construction, gas and electric lighting, hot water heating, maple and birch floors, hard wall plaster, metal ceilings, brass sliding poles, felt and gravel roofing, and the estimated cost is \$65,000.

Newport Centre, Que.

Tenders for the erection of a church building will be received by Cure, M. Jos. St. Laurent, until Jan. 15th. Plans at office of Presbytery and office of Architects, Ouellet & Levesque, Quebec.

Nicola, B.C.

Jas. Layfield, 1024 Broadway St. W., Vancouver, who has the contract for the court house, is receiving tenders for cement, lumber, plumbing, heating, painting, etc.

Regina, Sask.

Chief Zeats has recommended to the council the erection of police sub-stations, one in north side being wanted immediately.

River Glade, N.B.

F. Neil Brodie, architect, St. John, N.B., is preparing sketches for the remodelling of the Jordan Memorial Sanitarium, so as to accommodate 50 patients.

Sherbrooke, Que.

The Public Works Department has under consideration the erection of a post office and customs house.

Steeltown, Ont.

The work on the new post office will not be started until spring.

St. John, N.B.

Tenders will be called shortly by the Board of Hospital Commissioners for erection of concrete foundation, frame construction hospital. The estimated cost is \$25,000. Chairman, H. B. Schofield, City Hall.

The school board has under consideration the erection, on Douglas Ave., of a school of brick construction, concrete foundation and waterproofed. The estimated cost is \$50,000, and the architect will shortly be decided upon. The Board also contemplates erecting school buildings on Cliff St. and Leinster St., the architect for which will probably be R. West, Waterloo St.

Toronto, Ont.

H. F. McNaughten will receive tenders until Jan. 21st for carpentry and joiner work, plastering, painting and glazing at Government House, Rosedals. Plans are at the office of the Department.

CONTRACTS AWARDED

Coaticook, Que.

The contract for post office fittings has been awarded by Public Works Department to A. H. Cummings & Son, Ltd.

Kingsville, Ont.

The contract for the public building

has been awarded by the Public Works Department to E. Webb & Son, Orillia.

Montreal, Que.

The contract for the alterations to the Church of St. Henry, has been awarded to J. A. Charrette, St. Henry. \$25,000.

Ottawa, Ont.

The contract for the strengthening of Victoria Museum tower has been awarded to Foundation Co., Ltd., Montreal and Ottawa.

A contract for interior fittings at the public building has been awarded by the Public Works Department to Kyle's Cabinet Works, Ltd., Sparks St.

Portage La Prairie, Man.

The Dept. of Indian Affairs has awarded the contract for out buildings for Indian school to McCaig & Ellwood, for carpentry; Ritchie & Waters, for masonry.

Roberval, Que.

The contract for post office fittings has been awarded by Public Works Department to J. T. Schell Co., Alexandria, Ont.

Stonewall, Man.

The contract for the public building planned by Public Works Dept., has been awarded to General contractors, S. J. & J. B. Cooper & J. Watts. \$19,195.

St. Catharines, Ont.

The Public School Board has awarded the contracts for additions to Alexandra School to W. Bennett, 28 Catharine St., for masonry; E. Hudson, 60 Lake St., for carpentry; Leach & Jones, 46 James St., for painting; J. Peart, 49 King St., for heating; A. Riddle & Son, 283 St. Paul St., for plumbing; Sandham & Roberts, 237 St. Paul St., for electrical fittings.

St. George East, Que.

The Public Works Dept. has awarded the contract for post office fittings to Jos. Gosselin, Levis, Que.

St. Moise, Que.

The contract for the new catholic church has been awarded to Joseph Dagheau, Sacre-Coeur, Rimouski, Que. \$35,000.

Business Buildings and Industrial Plants

Caledonia, Ont.

The Haldimand Gypsum Co. contemplate the erection of a mill at the cost of \$20,000.

Calgary, Alta.

Plans in progress for remodelling front of the News-Telegram Bldg.

Granby, Que.

Bank (alterations), \$6,000, Main St.

The Hochelaga Bank, Montreal, has purchased a residence on Main street which will be converted into bank premises; the estimated cost of these alterations is \$6,000.

Hamilton, Ont.

Stewart & Witton, architects, have plans in progress for alterations to the store of A. M. Souter & Co., King St. W., at an estimated cost of \$6,000.

London, Ont.

Plans are in progress for alterations to

the Music Conservatory, at an estimated cost of \$10,000.

Montreal, Que.

Plans will shortly be prepared for a theatre and apartments on Mt. Royal avenue for P. G. Demetres, 559 St. James.

Niagara Falls, Ont.

The Niagara Linen Co., Niagara Falls, N.Y., has purchased a site on Fourth St. and propose erecting a \$50,000 factory.

Ottawa, Ont.

V. V. Rogers, Ltd., 193½ Sparks St., are considering the erection of stores and offices on Queen St., specification calls for 5 storeys, 66 x 90, Indiana stone facing, reinforced concrete and solid brick construction, concrete foundation, water-proofed, felt and gravel roofing, electric lighting, hot water heating, birch floors, plate glass, 1 passenger elevator, fire escapes, store fronts. The estimated cost is \$90,000.

T. A. Shore, 41 Chamberlain St., has under consideration the erection of an up-to-date laundry.

C. D. Joyce, 1102 Somerset St., contemplates the erection of a 3-storey store and apartment building at an estimated cost of \$12,000.

Papineauville, Que.

Papineauville Lumber Co. contemplate the erection of a mill for the manufacture of hardwood veneers for cooperage and cheese boxes.

Southampton, Ont.

The ratepayers have passed a by-law granting the Steel Furniture & Fittings, Ltd., free site and exemption from taxation for ten years.

Vernon, B.C.

Harry C. Moore, Blairmore, Alta., is negotiating with Board of Trade with a view to establishing plant to handle the by-products of the pine forests.

Windsor, Ont.

Leybourne & Whitney, architects, have sketches in progress for a three-storey store and office building of brick construction for Peter Osterhout. The estimated cost is \$25,000.

Woodstock, Ont.

The ratepayers have carried a by-law granting the Concrete Machinery Company loan of \$20,000 to be used in making improvements to their plant.

CONTRACTS AWARDED

Hamilton, Ont.

A contract has been awarded to Geo. E. Mills, 614 King St. E., by S. Epstein, 223 Jackson W., for stores building on James St. N.

London, Ont.

The contracts for stores and apartments on Central Ave and Richmond St., for H. M. Douglas, have been awarded to J. Moran & Sons, for masonry. J. A. Brownlee for roofing; Geo. Gould for plastering; Lewis Bros. for painting; Hunt Plumbing Co. for plumbing and heating; J. Pollock for electric fittings. The contract for carpentry is still open.

Montreal, Que.

The contract for alterations to Darwin's picture theatre has been awarded to J. Gillet.

Niagara Falls, Ont.

The contract for excavating for the store and apartment building of Wm. Place, on Queen St., has been awarded to Wm. Teal.

Quebec, Que.

The contract for alterations and additions to the store of Ed. Belanger & Co., has been awarded to Jobin & Frere.

In connection with the alterations to the Hochelaga Bank the following contracts have been awarded: General contract and carpentry, L. H. Peters. Masonry, C. Paradis. Painting, Marier & Tremblay. Heating, plumbing and electrical, Jobin & Paquet.

Residences

Brandon, Man.

A. E. Bullock, 13th and Princess Ave., has had plans drawn for the erection of a brick construction apartment block, the estimated cost of which is \$50,000.

London, Ont.

McBride & Gilbert, architects, have plans in progress for alterations to the residence of R. Lashbrook, 583 Richmond St. The estimated cost is \$5,500.

East London, Ont.

The McCormick Mfg. Co. have under consideration the erection of about 100 residences for their workmen. Architect is not yet appointed.

Montreal, Que.

A permit has been issued to J. V. Belanger, 2005 Christopher Columbus, for a three-storey apartment building. The estimated cost is \$15,000.

Montreal, Que. (Lachine)

J. Harris, architect, 180 St. James St., has drawn plans for the Marciel Trust Co. for the erection of ten frame construction residences at an estimated cost of \$25,000. Tenders will be called about February 1st.

Montreal, Que. (Notre Dame de Grace)

Montreal Builders, Ltd., 146 Fairmount W., have under consideration the erection of a number of up-to-date residences, which are estimated to cost \$50,000.

Montreal, Que. (Outremont)

Plans have been drawn for a residence for W. Charbonneau, 124 St. Zotique.

St. John, N.B.

The Hillsboro Woodworking Factory, Hillsboro, N.B., have plans in progress for the erection of 15 residences at Courtney Bay. Among those interested are H. B. Peck, East St. John; Allison Peck; W. H. Duffy, and W. P. Kirby, Hillsboro.

D. F. Pidgeon, Royal Bank Building; W. B. Tennant, King St.; Manning Doherty, 38 Cobourg St.; A. E. Massie, King St., and others, are interested in the possible erection of about twenty residences at Courtney Bay.

St. John West, N.B.

Algonquin Land Co., Ltd., care J. M. Queen, Canada Life Bldg., are considering the erection of about 25 one and two storey, concrete foundation, frame construction residences. The architect is not yet appointed.

Toronto, Ont.

Plans have been drawn by B. Brown,

architect, 218½ Queen St. W., for a 3-storey brick and steel apartment building for M. Goodheim (in trust). The estimated cost is \$12,000.

P. W. Colman, 167 Robert St., who has the contract for an apartment house on Christie St., for J. G. Hedges, is now open for sub-tenders.

James Stanhope, 2337 Yonge St., has just purchased a site on Balfour street and intends erecting thereon twelve 5-room workingmen's houses.

A. E. Packer, 63 Balsam Ave., has drawn plans for G. Scadding for three residences of brick construction, estimated to cost \$8,000.

Plans have been drawn for a pair of residences for E. Gagnon, 2359 Queen E.

J. Stanhope, 2287 Yonge St., has had plans drawn for the erection of two pairs of residences on Balfour street.

Winnipeg, Man.

Jordan & Owen, architects, Canada Life Bldg., have sketches in progress for two apartment blocks for A. S. Knight & Co.

Tenders will be received by S. Johnson, 683 Agnes St., until Jan. 15th, for the erection of an apartment block on Emily St. The estimated cost is \$50,000.

CONTRACTS AWARDED

Hamilton, Ont.

The following contracts for the 12 residences on Avalon St., for Wooley & Farewell, have been awarded: Mason, H. Cunliffe; plastering, O. Bayliss; heating, Havers Bros.; plumbing, W. W. Coffee & Co.; electrical fittings, A. Evans.

Montreal, Que.

The following contracts have been awarded in connection with apartment house planned by Jno. Gray; carpenter, M. Seguin; roofing, heating, plumbing and electrical fittings, R. Cyr.

Power Plants, Electricity and Telephones

Birtle, Man.

A by-law authorizing the installation of a telephone line at a cost of \$3,000 has been carried by the ratepayers.

Brigden, Ont.

The ratepayers have passed a by-law to raise \$4,000 for erection of electric lighting plant.

Fort. William, Ont.

The by-law has been carried by the ratepayers authorizing the expenditure of \$35,000 for extensions to the telephone system.

Guelph, Ont.

The ratepayers have passed a by-law to raise \$17,000 for the purchase of two new street cars.

Le Pas, Man.

A By-law was passed by the ratepayers Dec. 16th to raise the necessary funds for installation of electric lighting system.

Stratford, Ont.

A large number of new electric lighting services will be installed at once, new equipment for which will be required. Council Clerk, R. R. Lang.

Trenton, Ont.

Tenders will be received by Secretary, Public Works Department, until January 26th for electric wiring and fixtures in public building. Specifications at office of Thos. Hastings, Postal Station "F," Yonge St., Toronto, with J. Porter, caretaker, Public building, Trenton, and at the Department, Ottawa.

CONTRACTS AWARDED**Calgary, Alta.**

The city council has awarded the contract for 1,000 kw. synchronous motor generator and exciter set to General Supplies, Ltd., at \$18,250.

Port Colborne, Ont.

Public Works Dept. have awarded the contract for electric fitting at the public building to W. R. Savigny.

Walkerville, Ont.

The following sub-contracts have been awarded in connection with the Hydro-electric distributing station. General contractors, H. G. Christman Co., Hamilton, Ont.; steel, Canadian Bridge Co., Walkerville; plumbing, R. Paddon & Co., Windsor.

Winnipeg, Man.

The following contracts have been awarded for electric meters required by Board of Control: Packard Electric Co., Ltd., Winnipeg, single phase, 2-wire, 110-220 volt alternating; Ferranti Ltd., Winnipeg, 100-200 and 500 volt polyphase; Can. General Electric Co., Winnipeg and Toronto, single phase, 3-wire alternating; W. E. Skinner & Co., Ltd., Winnipeg, 2 and 3-wire, 250 and 500 volt, direct current.

Yorkton, Sask.

The Boving Co. of Canada, Ltd., has received the contract for the supply and delivery of one 500 B.h.p. combined unit Diesel required by the town council.

Miscellaneous**Kingston, Ont.**

City Engineer R. J. McClelland has recommended to the Board of Works the purchase of a mixing and heating plant for laying asphalt macadam.

London, Ont.

Hyatt Bros., 94 Egerton St., are in the market for six carloads of tapestry brick.

Montreal, Que.

Tenders received by Asst. Sec., M. P. Fennell, Jr., of Harbour Commission, until 12 o'clock noon, Jan. 19th, for unbroken and broken stone and ballast for 1914. Specifications at office of engineer.

Ottawa, Ont.

Tenders for addition to fuel testing plant will be received by Secretary of Public Works Dept., R. C. Desrochers, Ottawa, until 4 p.m. Jan. 26th. Plans, etc., at Dept., Ottawa.

Regina, Sask.

The following road machinery and street cleaning equipment was included in estimates for the year: 1 steam roller, half dozen slushers, 2 wheel scrapers, half dozen wheel barrows, 1 logging chains, 6 wagons, 4 sets sleighs, 1 dozen scoop shovels, 24 dozen special brooms, 1 dozen gutter shovels, 900 lbs. broom

filling, 2 dozen hand trucks, 2 tank wagons, 3 squeegee machines. Engineer, F. McArthur.

Victoria, B.C.

Tenders will be received by city council until 4 p.m. Jan. 19th for general hardware, castings, hydrants, sewer brick, sewer pipe, sand and gravel, cement, lumber, slabwood, etc. Clerk, W. J. Dowler.

Vancouver, B.C.

Tenders will be called shortly by Board of Education, Gerald Upton, Sec., for repairing and renewing heating and ventilating plants in about 30 schools.

Winnipeg, Man.

Tenders will be received by the Board of Control until Jan. 16th for the supply of galvanized meter fittings for 1914. Sec., M. Peterson.

Westboro, Ont.

David Currie is considering the purchase of a compressed air plant for drawing water from well, to replace one destroyed.

CONTRACTS AWARDED**Berlin, Ont.**

Town Council (Light Commission) have awarded the contract for the supply of two gas retorts to the Improved Equipment Co.

Ottawa, Ont.

The contract for wire required by the City Council has been awarded to Canada Wire & Cable Co., Ltd., 1170 Dundas St., Toronto.

Winnipeg, Man.

The contract for gas testing apparatus has been awarded by the Board of Control to Alexander, Wright & Co., Ltd., London, at \$2,403.52, f.o.b. Winnipeg.

New Companies

The Baker Construction Co., Ltd., has been incorporated with a capital of \$40,000, with head office at Toronto. The provisional directors are J. J., H. E., and G. Baker, J. E. Day and J. M. Ferguson, all of Toronto.

The Eureka Fence Brace Co., Ltd., has been incorporated with a capital of \$20,000, with head office at Essex, Ont. The provisional directors are W. Church, H. F. Wigle, A. W. Massey, A. W. Wood and J. E. Hutchinson, all of Essex, Ont.

Patrick Building Co., Ltd., has been incorporated with a capital of \$200,000, with head office at Toronto. The provisional directors are R. L. Johnston, R. D. Moorhead, L. Macauley, J. E. Anderson and W. G. Patrick, all of Toronto.

Aird Island Logging and Trading Co., Ltd., has been incorporated with a capital of \$10,000, with head office at Spanish Mills, Ont., to carry on a general lumber business. The provisional directors are R. McKay, D. Inglis Grant, M. MacDonald, G. Adams and E. Smily, all of Toronto.

Canadian Kennedy Manufacturing and Engineering Co., Ltd., has been incorporated with a capital of \$40,000, with head office at Niagara Falls, Ont. The provisional directors are C. Murphy, H. Fisher, L. P. Sherwood, R. Laurier and J. W. Valentine, all of Ottawa.

Excelsior Plate Glass Co., Ltd., has been incorporated with a capital of \$50,000, with head office at Toronto.

000, with head office at Toronto. The provisional directors are J. I. Grover, W. C. Davidson and M. C. Pritchard, all of Toronto.

East Main Street Welland Syndicate, Ltd., has been incorporated with a capital of \$40,000 to carry on business as a general land and building company, with head office at Toronto. The provisional directors are F. Bott, J. H. Flett and T. A. Silverthorn, all of Toronto.

Erie Construction Co., Ltd., has been incorporated with a capital of \$40,000, with head office at Toronto, to carry on business as general contractors. The provisional directors are J. S. Duggan, P. W. Beatty, B. H. L. Symes, W. R. Anderson and T. S. H. Giles, all of Toronto.

The Bow Island Sewer Pipe and Tile Co., Ltd., has been incorporated with a capital of \$200,000, with head office at Bow Island, Alta.

The Peace River Land and Development Co., Ltd., has been incorporated with a capital of \$100,000, with head office at Edmonton, Alta.

The Calgary Lumber and Supplies, Ltd., has been incorporated with a capital of \$100,000, with head office at Calgary, Alta.

J. H. Allard, Ltd., has been incorporated with a capital of \$50,000, with head office at L'Epiphanie, Que., to carry on business as lumbermen and timber merchants. The provisional directors are J. H. Allard, G. Dufort, J. E. Mageau, of L'Epiphanie, Que., and J. E. Cote and T. J. Shallow, of Montreal.

A. B. See Electric Elevator Company of Canada, Ltd., has been incorporated with a capital of \$100,000, with head office at Montreal. The provisional directors are L. A. David, L. E. A. D'Argy-Mailhiot, C. J. E. Charbonneau, A. Blanchard and H. L. Butteris, all of Montreal.

The Hilton Electric Co., Ltd., has been incorporated with a capital of \$50,000, with head office at Montreal. The provisional directors are W. R. Hilton, S. G. and A. Isenman and G. A. Curtis, all of Montreal.

Good Roads Machinery Company, Ltd., has been incorporated with a capital of \$200,000, with head office at Winnipeg, Man., to carry on business as manufacturers of road-making machinery, etc. The provisional directors are W. E. Clark, manufacturer, J. Smith, ditching contractor, T. C. Parkin, chartered accountant, B. Clement, mechanical engineer, and F. H. Blucke, insurance agent, all of Winnipeg, Man.

Laurentide Summer Homes Limited, has been incorporated with a capital of \$40,000, with head office at Montreal, Que., to carry on business as a general land and building company. The provisional directors are D. R. Hemsley, manufacturer, J. A. H. Hebert, notary, J. C. Gagne, manager, E. C. Vidricaire and J. F. Boulais, brokers, all of Montreal.

Sanibuild, Limited, has been incorporated with a capital of \$50,000, with head office at Montreal, Que., to carry on business as dealers in builders' materials, etc. The provisional directors are C. J. E. Charbonneau and A. Blanchard, notaries, L. J. M. Dugas and L. E. A. d'Argy-Mailhiot, advocates, and G. Salmon, engineers, all of Montreal.

Tenders and For Sale Department

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent. an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929, Contract Record, Toronto. 53-12

To Contractors

Sealed tenders marked "Tender for Works," addressed to the undersigned, will be received at this department up to noon on Wednesday, the 21st January, for the Carpenter and Joiner Work, Plastering, Painting and Glazing of the New Government House, Rosedale, Toronto. Plans and specifications can be seen at this department. An accepted bank cheque payable to the Hon. J. O. Reaume, Minister of Public Works, for five per cent. of the amount of the tender and the bona-fide signatures and addresses of two sureties or the name of a guarantee company approved by this department, willing to provide bond for the due fulfilment of the contract, must accompany each tender. The Department is not bound to accept the lowest or any tender.

By order,

H. F. McNAUGHTEN,
Secretary Public Works Department.
Department Public Works, Ontario.
Toronto, January 8th, 1914.

Newspapers publishing this advertisement without authority will not be paid for it. 2



Sealed tenders addressed to the undersigned, and endorsed "Tender for Additions to Fuel Testing Plant, Ottawa, Ont.," will be received until 4 p.m., on Monday, January 26, 1914, for the above mentioned Additions to Fuel Testing Plant, Ottawa, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.
Department of Public Works,
Ottawa, January 3, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51742. 1-2



Temiskaming and Northern Ontario
Railway Commission

Sealed Tenders

Sealed tenders addressed to the undersigned and marked on envelope "Tender for Restaurant Privileges, Temagami," will be received up to 12 o'clock noon, February 10th, for the News and Restaurant Privileges at Temagami Station for one year from February 10th, 1914.

Successful tenderer will be required to supply fuel for all purposes, including heating.

Certified cheque for ten per cent. of tender price to accompany tender.

Highest or any tender not necessarily accepted.
Dated at Toronto this 8th day of January A.D., 1914.

A. J. McGEE, Secretary, Treasurer,
T. & N. O. Ry. Commission,
25 Toronto Street,
Toronto, Ont.

2



Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon, on Tuesday, January 20, 1914, for the construction of the following works, viz.:

SEWERS

Benson Avenue—120 feet east of Shaw Street to east side of Alberta Avenue.

Boon Avenue—454 feet north of Ascot Avenue to 83 feet north of Morrison Avenue.

Day Avenue—283 feet south of Hope Avenue to 90 feet north of Morrison Avenue.

Earlscourt Avenue—N.S. Hope Avenue to 83 feet north of Morrison Avenue.

Fir Avenue—Balsam Avenue to Beech Avenue.

Goodwood Ave.—Dufferin St. to Boon Avenue.

Harvie Avenue—N.S. Hope Avenue to 83 feet north of Morrison Avenue.

Hope Avenue—Dufferin Street to east side of Earlscourt Avenue.

Lane, first south College Street—McCauley St. to Henry Street.

Lane, first south Dupont Street—Manning Ave. to east end.

Lane, first north Gould Street—Dalhousie St. to Mutual Street.

Lane, first west of Roncesvalles Avenue—Geoffrey Street to south end.

Nairn Avenue—N.S. Hope Avenue to 83 feet north of Morrison Avenue.

Ryerson Ave.—Grange Ave. to 118 feet north.

Sellers Avenue—282 feet south of Hope Ave. to 90 feet north of Morrison Avenue.

Sparkhill Ave.—Logan Ave. to 646 feet west.

Wade Avenue—Lansdowne Avenue to east side of Brown Avenue.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen and forms of tenders obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tenders the names of two sureties, approved of by the City Treasurer, or in lieu of said sureties the bond of a Guarantee Company, approved of as aforesaid. Conditions relating to tendering as prescribed by City By-laws must be strictly complied with. The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control,
City Hall, Toronto, January 8, 1914. 2

Good Opportunity to Importers of Waste and Steels

Firms interested in above write

British Manufacturers' Association,
Limited
803 McGill Building, Montreal 2-4

CITY OF MOOSE JAW

Tenders for Street Signs and Numbers

Sealed tenders marked "Tender for Street Signs and Numbers," will be received by the City Commissioners up to 12 o'clock noon on Saturday, January 17th, 1914, for furnishing the City of Moose Jaw with street signs and numbers, in accordance with specifications on file in the office of the said Commissioners.

The lowest or any tender not necessarily accepted.

JAMES PASCOE,
L. W. RUNDLETT, City Commissioners.
W. F. HEAL,

Moose Jaw, December 27th, 1913. F

Wanted Employees

WANTED—First-class Architectural Draughtsman. Permanent situation if satisfactory. State terms and experience. Box 937 Contract Record, Toronto. 2-3

Business Notes

Hull, Que.

The store of Jos. Couture, 145 Main St., Hull, Que., which has been destroyed by fire, will rebuild.

Montreal, Que.

The following residences in St. Louis Sq. have been destroyed by fire: Louis C. Rivard, No. 26, loss \$35,000; Joseph Monette, No. 30, loss \$25,000; S. Taplis, No. 34, loss \$25,000.

The store of G. W. Stephens, 362 St. Catherine W., has been destroyed by fire. Loss \$70,000.

Napanee, Ont.

The opera house has been destroyed and the Biscoe Hotel badly damaged by fire. Estimated loss \$20,000.

Ottawa, Ont. (Eastview)

Stores and residences of Amber & Co., Montreal Rd. and Park Ave., have been damaged by fire; loss about \$6,000.

S Rathroy, Ont.

The woodworking factory of J. W. Cameron has been damaged by fire, the main building being destroyed. The premises are fully covered by insurance.

St. John, N.B.

The residence of Walter Pederson, Coldbrook, has been destroyed by fire. Loss is estimated at \$6,000; insurance \$5,500. To be rebuilt at once.

“Inglis” Corliss Engines

are known above all others as being pre-eminently “Engines of Quality,” Economical, Durable and Reliable and can be depended upon to give the same good results twenty years from now.

We build them Single, Tandem, Compound and Triple, for heavy or light duty. Remember our Fifty year reputation is back of every “INGLIS” engine. Specifications and prices upon request.

The John Inglis Company

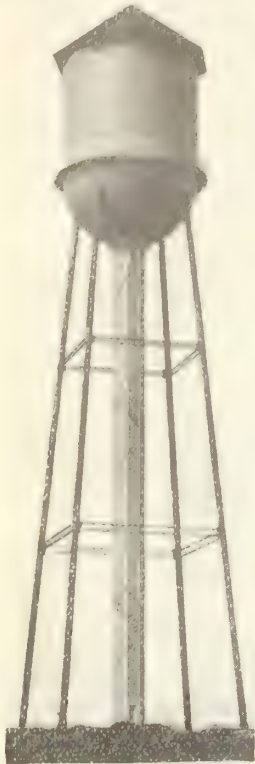
ENGINEERS AND BOILERMAKERS

Limited

14 Strachan Ave.,

Toronto, Canada

Montreal Office: Room 509 Canadian Express Building



Built for City of Wetaskiwin,
Sask., City Waterworks.

Canadian Plant Chicago Bridge & Iron Works BRIDGEBURG, ONT.

Our specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Buildings and Structural Material.

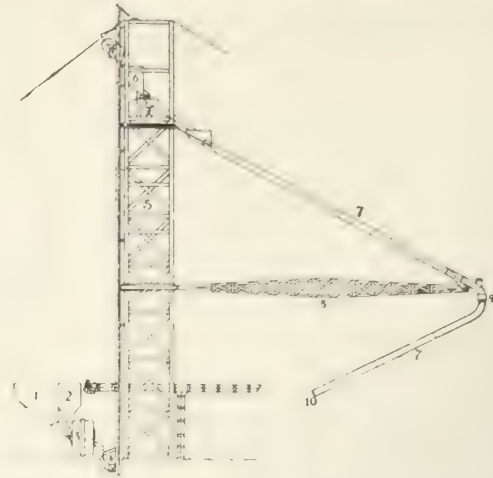
Write to-day for Canadian
Illustrated Catalogue No. 15.

OFFICES :

130 Janet St., Bridgeburg, Ont.
1360 W. 105th St., Chicago, Ill.

SHOPS :

Bridgeburg, Ont.,
Chicago, Ill., Greenville, Pa.



Gravity System Distributing Concrete

A system that improves the concrete and reduces the cost.

Information gladly furnished and Estimates given on any work.

Canadian Concrete Appliance Co.

Sole Licensees for Canada

Limited

613 Vancouver Block, VANCOUVER, B. C.

Eastern Representatives

STINSON REEB BUILDERS' SUPPLY CO., LTD., MONTREAL, P.Q.

PURE WATER

It is easy to obtain with our plants
and apparatus

We design and contract for complete municipal filtration plants of any capacity.

We supply and install apparatus for sterilizing water supplies by the application of calcium hypochlorite.

Literature, Sketches, Estimates and Recommendations Supplied on Request

American Water Softener Co.

1001 Chestnut St., PHILADELPHIA, Pa.

We have no affiliations or working acquirements with any of our competitors.



S. M. Underhill's Bungalow, Stained with Cabot's Creosote Stains and lined with Cabot's Quilt. Designed and built by Tracy L. Freeman, Nyack, N. Y.

"Cabot's Stains are the only Stains I use when I get up the specifications, and if I build where other's specifications call for other stains I try and get them over to Cabot's, for I know the results are better for all concerned." TRACY L. FREEMAN.

THE ONLY REAL STAINS

If you have only seen the crude and tawdry colors of the thinned paint imitations of

CABOT'S SHINGLE STAINS

you have no idea of the beautiful coloring effects of the true Stains. They are soft and deep, like velvet, but transparent, bringing out the beauty of the wood grain. Half as expensive as paint, twice as handsome, and the only Stains made of Creosote, "the best wood preservative known."

CABOT'S "QUILT" Cold-Proof, Heat-Proof, Sound-Proof, 40 Times Warmer than Common Papers.

Send for samples and full information.

SAMUEL CABOT, Inc., Sole Manufacturers
BOSTON, MASS., U. S. A.

Canadian Agents:

A. Muirhead Co., Toronto.

Henry Darling, Vancouver.

Saskatchewan Supply Co., Saskatoon.

Braid & McCurdy, Winnipeg.

Seymour & Co., Montreal.

Can. Equipment & Supply Co.,

Calgary and Edmonton.

F. A. Gillis & Company, Halifax and Sydney.

Goold, Shapley & Muir Co.

Brantford Limited Winnipeg Regina Calgary



Towers
and Tanks
for all pur-
poses.

Concrete
Mixers

Gas and
Gasoline
Engines

Hoists

Windmills

Water supply outfits of every
description.

CORRESPONDENCE SOLICITED

"Metallic"

"Eastlake" Shingles

are ideal in design for prompt and perfect work in making fireproof, lightning-proof and weather-proof roofs. "Eastlake" Shingles are the easiest and quickest-laid shingles on the market—no mechanic is needed to lay them. In use years before any other metal shingles were made in Canada.

Meet the immense and growing demand for metal shingle roofs by getting our information and selling terms to-day. The "Eastlake" long service records ensure lasting satisfaction to you and your customers.

Remember: It pays to handle the "Eastlake."

THE METALLIC ROOFING CO.
OF CANADA LIMITED.
TORONTO AND WINNIPEG

Contractors' Acetylene Flare Lights

Made in Two Sizes

SIZE NO 1—

8,000 Candle Power, operates 12 Hours on 18 lbs. Carbide.

Price F.O.B. Ottawa \$95.00.

SIZE NO. 2—

1,000 Candle Power, operates 12 Hours on 8 lbs. Carbide.

Price F.O.B. Ottawa \$65.00.

Manufactured by

International Marine Signal Co.
Ottawa, Canada Limited



For Sale or To Rent

- 10 Tons $\frac{5}{8}$ and $\frac{3}{4}$ x 18-in. Drift Bolts.
- 1—9 x 14 "Porter" Locomotive, 36 Gauge, Steam Brakes.
- 1—7 x 10 Upright Stationary Engine.
- 3—Large Rendering Kettles.
- 1—10-Ton Derrick.
- 1—Ledgerwood Steam Swinger.
- 2—No. 5 Pulsometer Pumps.
- 1—10-Ton Screw Press.
- 1—8½ x 10 Lambert Skeleton Hoist.
- 1—7 x 12 Beatty Hoist D.D. and Swinger.
- 3—½-Yard Smith Concrete Mixers.
- 1—D. D. Electric Hoist.
- 1—4 H.P. Gray Stationary Gasoline Engine.
- 1—12x18 Stationary Engine with Tubular Boiler.
- 1—80 H.P. Tubular Boiler.
- 1—(J. I. Case) 10-Ton Road Roller (New).

*The above machines are but
slightly used and are in
good working order.*

Fleming Machinery Company
340 Sparks Street, Ottawa, Can.

“**PRESSED
BRADFORD
BRICK**”
(TRADE MARK REG. U. S. PATENT OFFICE)
JUST RED

But we are proud of that RED—rich, unusual, pleasing and absolutely unfading.

Only the famous Bradford Red Shale gives that color.

Only the renowned “BRADFORD PRESSED BRICK” has it.

That color, plus mechanical excellence, makes

**“BRADFORD
PRESSED BRICK”**

(Trade Mark Reg. U. S. Pat. Office)

the **Standard Red Brick of America.**

Made, sold and found most excellent for 20 years.

“BRADFORD REDS”—a smooth brick of superior texture, uniformity of color and general excellence. Dry pressed—made in both Standard and Roman sizes with stock ornamentals. Wire cut impervious—made in Standard Sizes.

“Bradford Ruffs”—a rough texture brick of the same beautiful color. For garden walls, bungalows and other unusual effects.

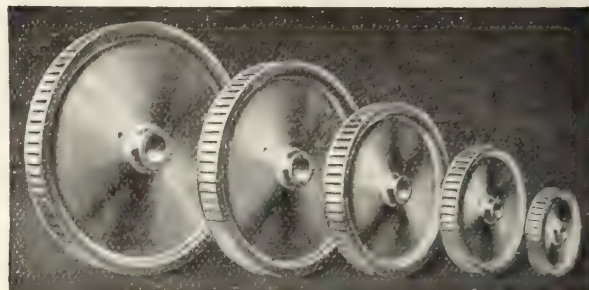
Have you seen our “RED” Catalog?

Bradford Pressed Brick Co.

“The Red Brick People”

Bradford, Pa.

**The Rotor with
the Solid Buckets**



Upon the design and construction of the rotor depends
the ultimate success or failure of the Steam Turbine.

Notice the above illustration of the Sturtevant Steam Turbine rotors. See the solid milled-in buckets with their straight edges (not found in any other turbine). There is no chance there for broken buckets, wrecked turbines or reduced efficiency through steam leakage from one bucket to the other.

These buckets of

Sturtevant
(REG. U. S. PAT. OFF.)

Steam Turbines

are milled into a solid steel forging of a chemical composition that resists corrosion or pitting. The rotors are then given a perfect static balance, which, because of their symmetry means a practically perfect dynamic balance. They are fastened to the shaft by a ground taper fit, and the entire rotor (not merely the buckets) is carefully polished to minimize rotation losses.

This is only one detail in the design and construction of this highly efficient turbine. Others are described in our catalog 210—Z.

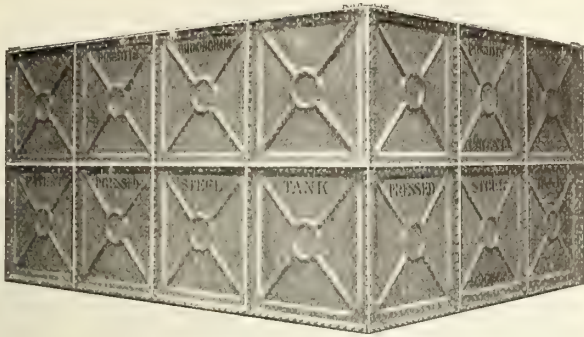
Remember that STURTEVANT Turbines are adapted to driving any apparatus at its most efficient speed.

**We would be glad to write you fully as to how
this turbine would meet your requirements.**

**B. F. Sturtevant Company
of Canada, Limited**

Galt, Ontario

SALES OFFICE FOR EASTERN CANADA
919 New Birks Building, Montreal



Made in any length or width in multiples of 4-ft. by 8-ft. or 12-ft. deep.

Patent Pressed Steel Tanks

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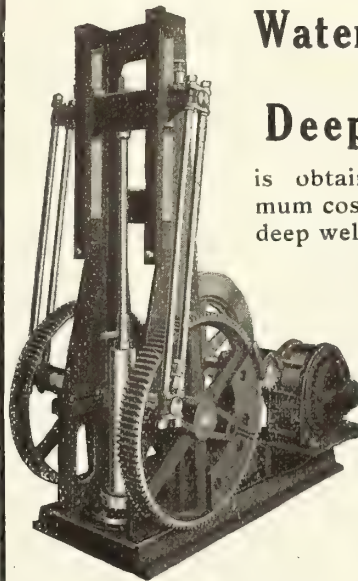
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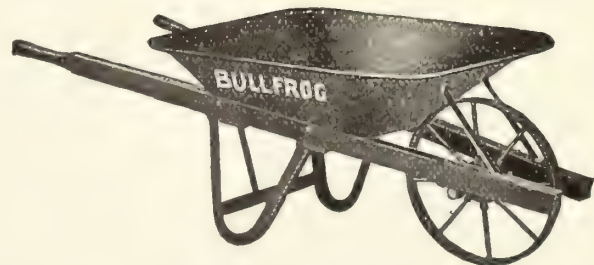
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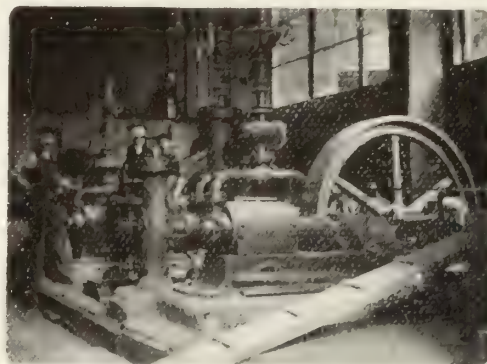
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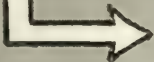
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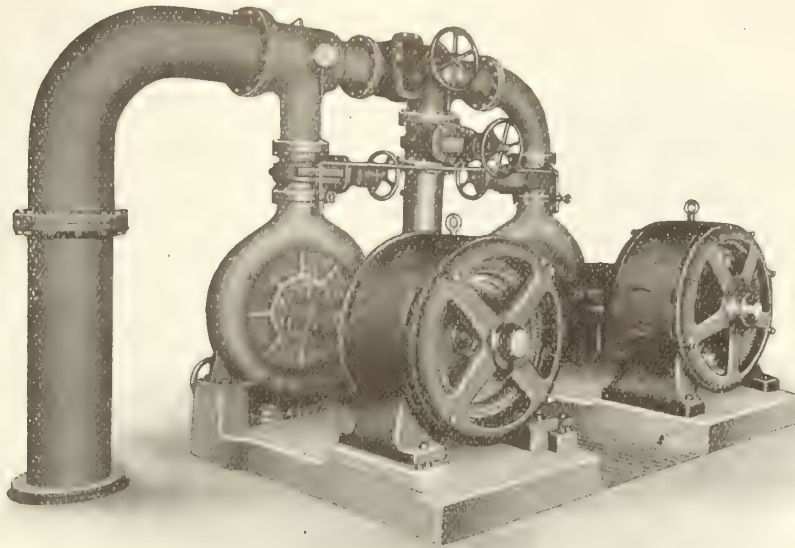
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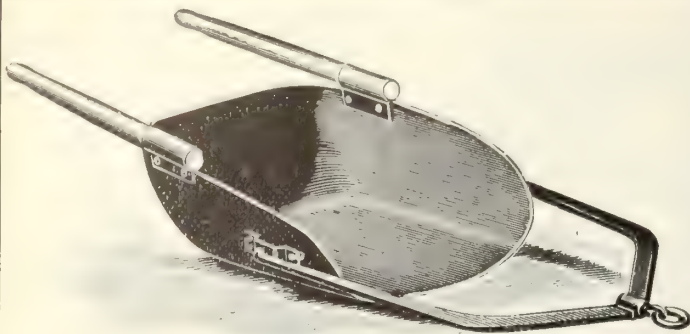
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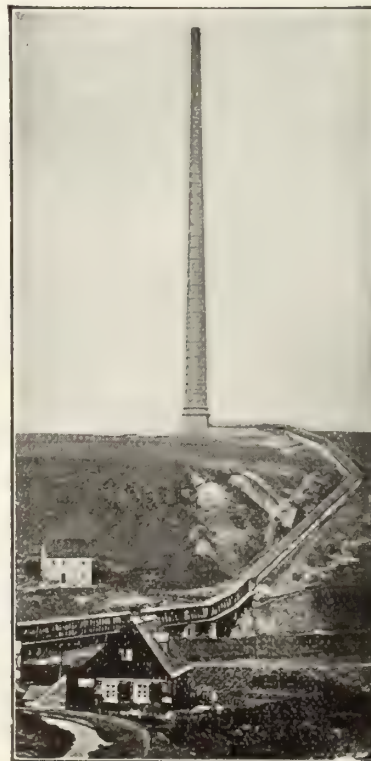
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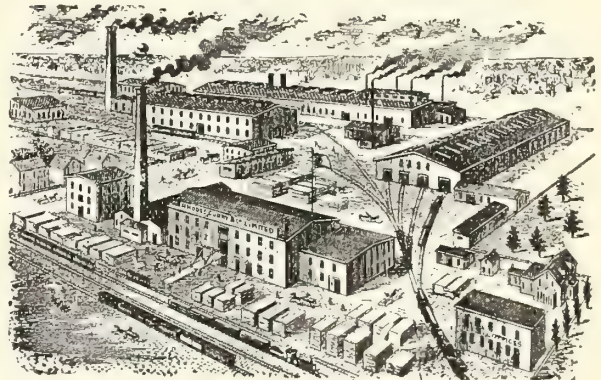
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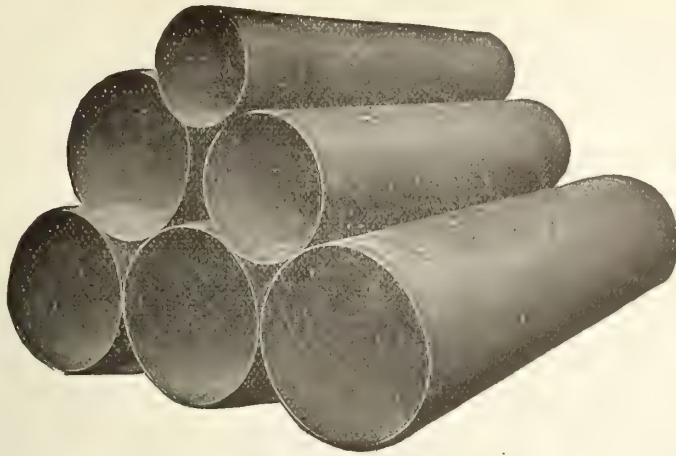


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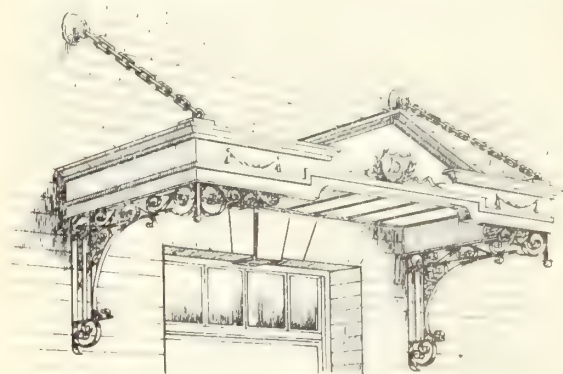
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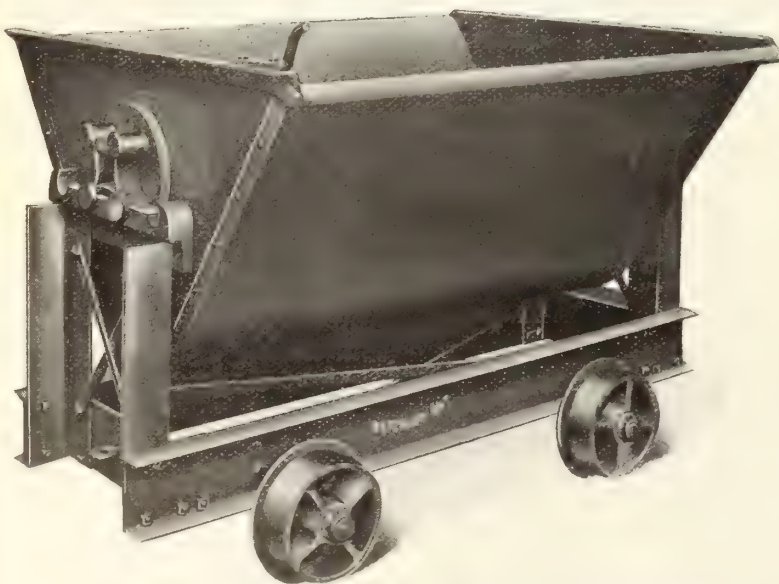
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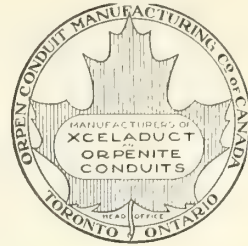
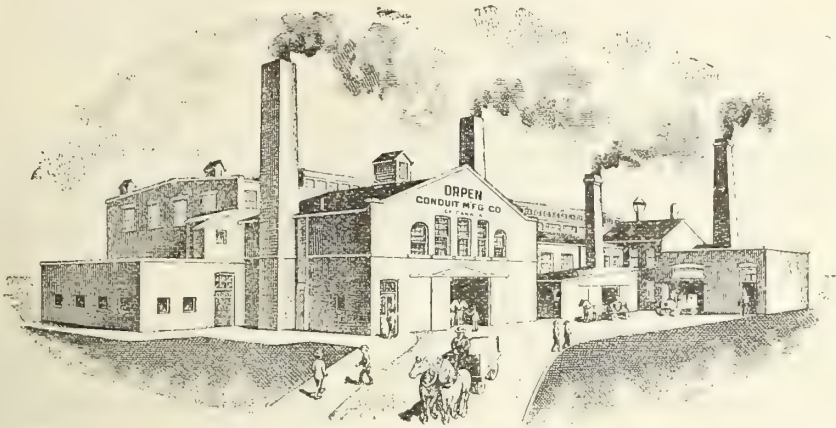
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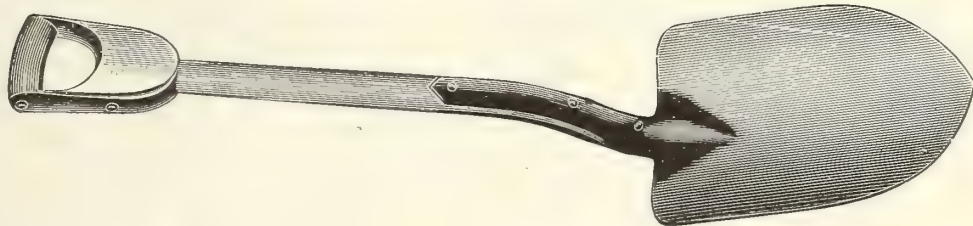
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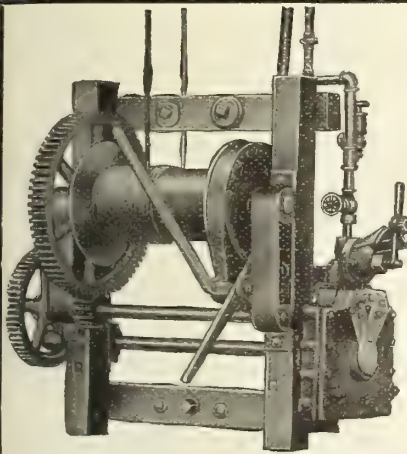
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Red Stock Bricks	13 00
Grey Stock Bricks	12 00
Wire cut bricks for foundation work	11 00
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	\$80 00 to \$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—	
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	\$26 00
2 x 4 to 2 x 12, 16 ft.	26 00
2 x 4 to 2 x 12, 18 ft.	29 00
1 in. Hemlock, No. 1	25 00
No. 1 Hemlock Decking	25 00
No. 2 Hemlock dimension and 1-in.	19 00
Pine—	
1 in. common pine 8 to 12 in. wide rough	26 00
2 in. white pine Bill stock	29 00
3/4 x 8 and 10 in. pine shelving	38 00
3/4 x 12 in. pine shelving	45 00
No. 1 white pine flooring	33 00
No. 1 spruce flooring	28 00
No. 1 pine decking D2S	30 00
Spruce Decking	28 00
No. 1 pine V. or headed sheeting	36 00
No. 2 pine V. or beaded sheeting	32 00

Pine trim for paint finish—	
4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 60
8 in. pine base, per 100 ft.	3 60
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—	
XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 60
No. 1 spruce lath	4 00

Cedar Posts—Fence—	
5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:	
8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$ 6 25
26 to 40 "	4 00	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	\$3 25	\$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	\$3 50	\$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 65 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 70 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net \$1.85
No. 4 1/2 Fuller's net \$2.35
Square head brass cocks, 65 and 5 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6 1/4 cents per lb.; traps and bends, 40 per cent.; pig lead, 6 1/4 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black	Galvanized
1/4 inch	\$2.16	3/4 inch \$3.06
3/8 "	2.16	1 " 3.06
1/2 "	2.64	1 1/2 " 3.57
3/4 "	3.05	2 " 4.20
1 "	4.51	2 1/2 " 6.21

1 1/4 "	6.10	1 1/2 "	8.40
1 1/2 "	7.29	1 3/4 "	10.04
2 "	9.81	2 "	13.51
2 1/2 "	16.80	2 1/2 "	21.65
3 "	20.66	3 "	28.31

Cast iron fittings, 65; headers, 65; ranged unions, 70; malleable bushings, 67 1/2; nipples, 4 inch diameter and under, 75 and 10; nipples, 4 1/2 inch and up, 70 and 10; malleable lipped unions, 6 1/2 per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 and 10 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.

Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; 3/4-inch, \$1.45.

Burnt River rubble stone delivered, \$16 to \$17 per ton.

Main steel bars, \$2.25.

Square twisted bars, 3/4 to 1 1/4, \$2.35.

Malleable fittings — Canadian discount, 45 and 42 1/2 per cent.

Free stone delivered, \$15 to \$18 per ton.

Brown coursing stone, delivered, \$3.75 per yard.

Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.

Sand, for cement or brick work, \$1.20 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 85c to \$1.00 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, \$1.30 per ton.

Steel channels and beams, angles and plates, \$2.55 to \$2.90 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from \$8.00 to \$8.50, bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, \$1.50 bbl.

Manilla Rope, best, per pound, 12 1/2 cents.

PAINTS AND OILS

Pure White Lead, ground in oil, \$8.75 per 100 lbs.

Boiled Linseed Oil in bbls., 65c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 62c per gallon.

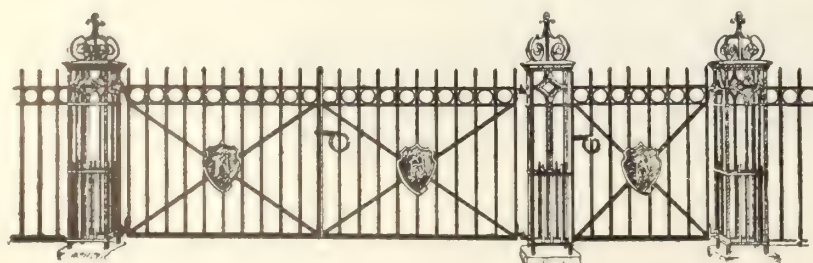
Pure Red Lead, dry, \$7.00 to \$8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3 1/4c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 66c.

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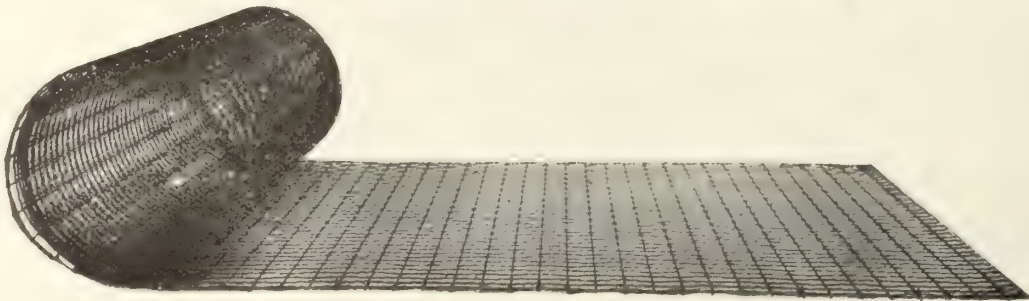
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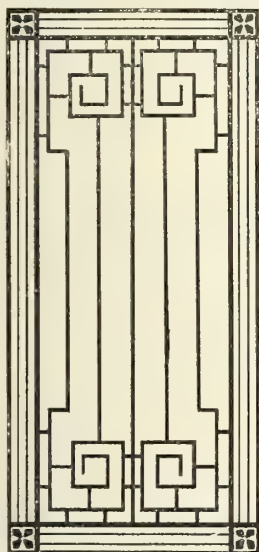
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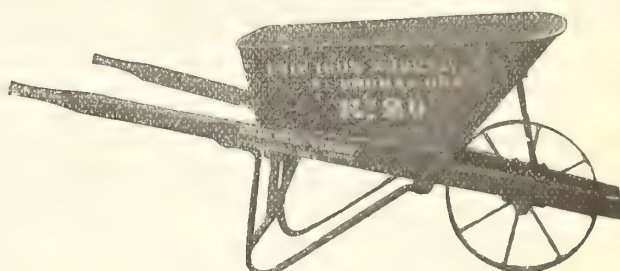
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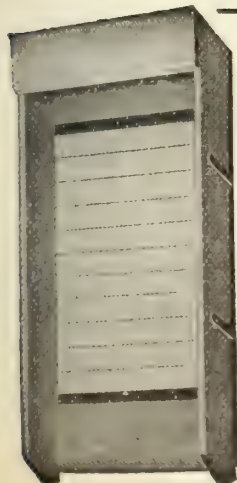
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The legs are made of channel iron and thoroughly braced.

The wheel is guarded and the barrow may be dumped forward or at sides.

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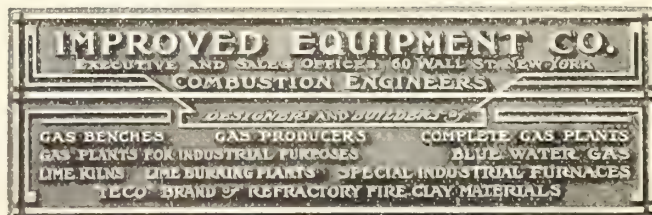
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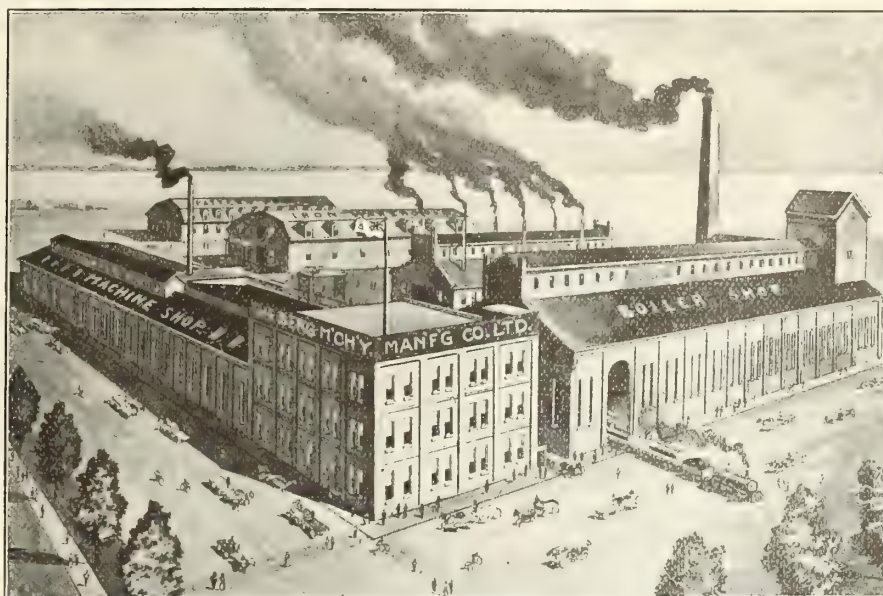
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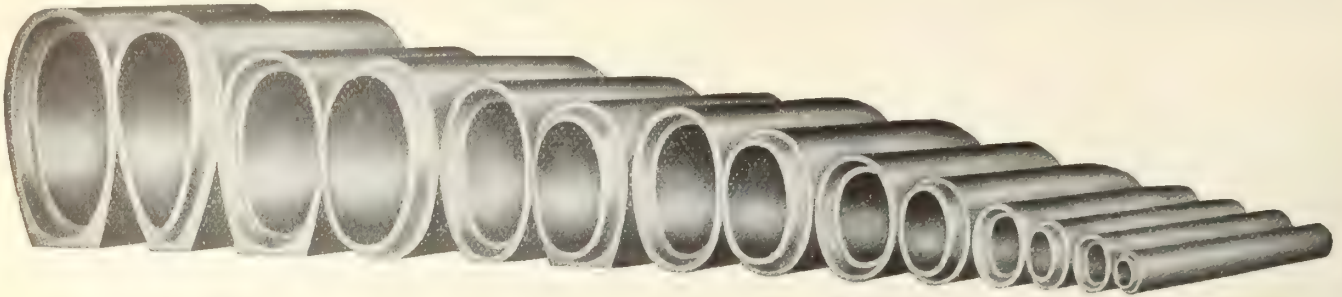
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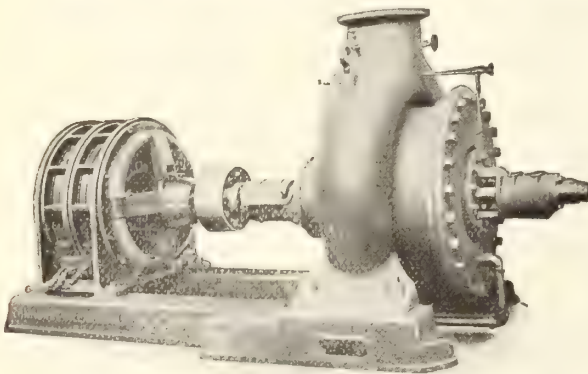
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This Cartoon, reproduced by permission from "Industrial Canada" of November last, graphically depicts the serious problem of Canada's heavy fire losses. Our solution is:

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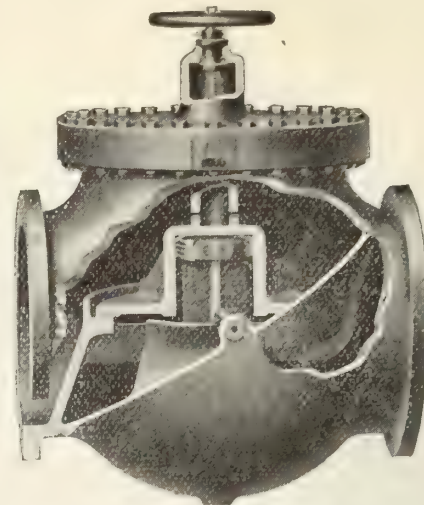
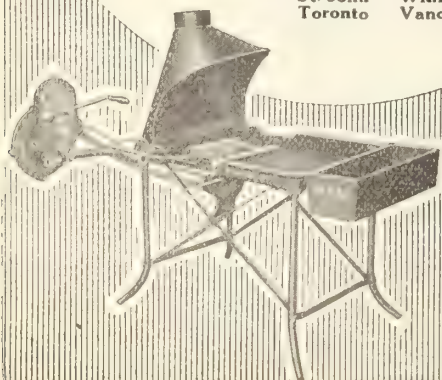
Forges

"Built to Last"

is the slogan of our 1912 Rivet Forge. The repair cost by this design is guaranteed to be actually **cut in two**, compared with any other forge now in the market. A bridge company using a large number of forges writes us regarding it: "The operator claims it runs easier and heats more rivets in less time than any forge he has ever used." Let us send you one on free trial. Fifty other styles, for light and heavy work.

Canadian Buffalo Forge Co.

Montreal Limited
St. John Toronto Winnipeg Vancouver



Horizontal Automatic Exhaust Relief Valve

We make automatic exhaust relief valves of all sizes and types—horizontal, vertical, angle and downward discharge. An inside dashpot of ample size eliminates shock in closing and a water seal insures the valve against leakage.



ATWOOD

**PITTSBURGH VALVE,
FOUNDRY & CONSTRUCTION CO.
PITTSBURGH, PA.**



ATWOOD

ENGINEERS FOUNDERS MACHINISTS

JAS. DICKSON, Pres.

GEO. T. DICKSON, Vice-Pres.

Dickson Bridge Works Co.

Campbellford, Ont.

Limited



Bridge over Spanish River at Massey, Ont.

Steel Bridges, Steel Buildings Roof Trusses

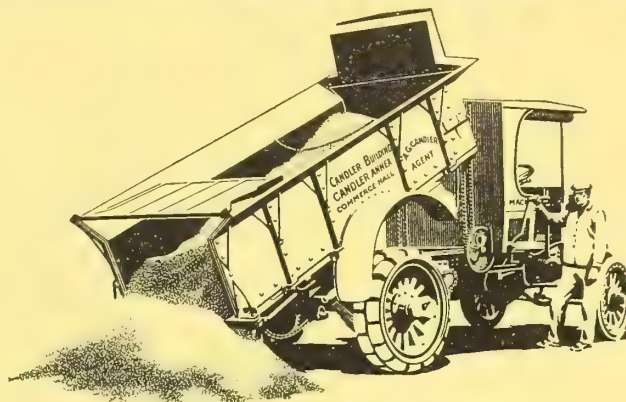
and other Structural Steel

Foundry and Machine Shop in connection.

Estimates on application



A Mack Truck That Replaced Five Double-Teams In Winnipeg



The five-ton Mack Dumping Truck shown here is owned by the Lake Winnipeg Shipping Company, Limited, and it has replaced five double teams, the service of which teams would cost approximately \$30.00 per day. This truck is engaged in hauling gravel, sand and rubble from the docks to various points throughout the city. The heavy mud which forms on the unpaved roads after rainfalls does not interfere with its operation.

We have records of hundreds of five-ton Mack Trucks that are earning from \$30.00 to \$50.00 per day.

Mack Trucks have proven their reliability, economy and long life by 12 years of real service in every line of transportation.

You should investigate the Mack before buying a truck. Ask us to show you.

The Canadian Fairbanks-Morse Co., Limited

St. John, N.B. Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver

9



Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

Seventh of a series of advertisements showing buildings of national importance which have been wired with the Imperial Wire and Cable Co's. Limited, wires.

This picture shows the

World Building, Vancouver

This building was wired with

"Adanac" Rubber Insulated Wire

Architect: W. T. Whiteway, Vancouver.

Engineer: W. E. Hughes, Vancouver.

Electrical Contractor: J. G. Sutton, San Francisco, Cal.

Address enquiries to nearest office

MONTREAL TORONTO WINNIPEG

Enquiries from Alberta and British Columbia may be addressed to Northern Electric & Manufacturing Co., Ltd., Calgary and Vancouver.

"ADANAC" "IMPERIAL HIGRADE" and "30% PARA"



Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

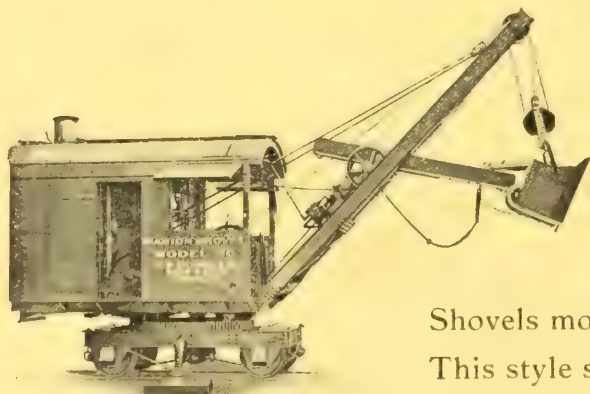
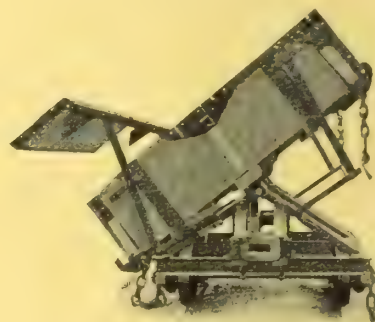
Brickyards, Quarries,
Mines, Contractors, etc.

All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.



“MARION” STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
58 - 1 and 112 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks.
This style shovel is specially adapted for Brickyards—Mines
—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

BRANCH OFFICES

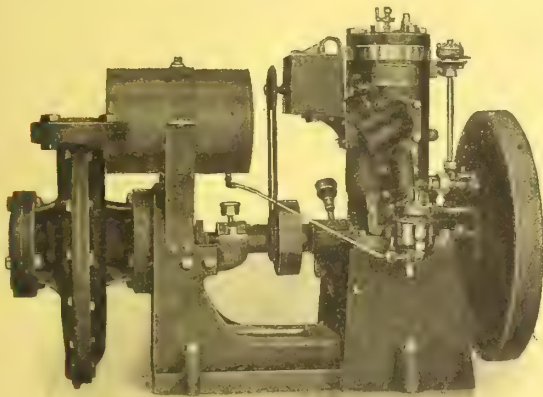
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Ritchie Contracting & Supply Company, Ltd., Vancouver Agents

Contract Record

ESTABLISHED 1886

and Engineering Review

We stand behind our Pumps
Entire satisfaction guaranteed



The SMART-TURNER MACHINE CO., Limited
HAMILTON, CANADA

"MADE IN CANADA"

Bent Glass

Made in all
Kinds of
Glass
on Short
Notice

Large Bent Plate Glass for Shop
Fronts a Specialty

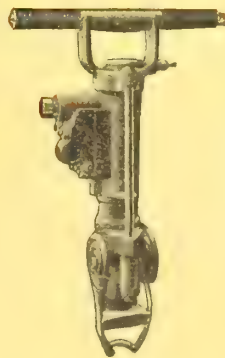
The Toronto Plate Glass Importing
Company, Limited

(HILL & RUTHERFORD, Managing Directors)

Head Office and Works: 91 to 133 Don Roadway
TORONTO

THE "JACKHAMER"

is self-rotating,
self-lubricating
and it is an all-
steel drill oper-
ated by steam
or air.



A "One-Man Drill"

which will make
a decided re-
duction in your
drilling costs.
The drill you
are looking for.

*A Copy of K-68 will
interest you. Ask
us for it.*

Canadian
Ingersoll-Rand
Co., Limited
MONTREAL, CAN.



Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems,
Fire Protection, Power Plants,
Hydraulic Mining, Irrigation, etc.
One-half the cost of Iron Pipe—
and better.

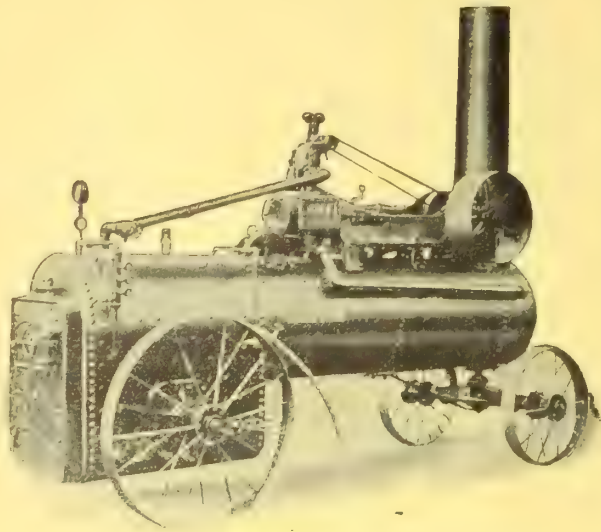
Pacific Coast Pipe Co., Limited

P. O. Box 563 Vancouver, B. C.

Office and Factory, Granville St., near High Bridge

WRITE FOR CATALOGUE

Full Particulars and Estimates Furnished



Portable Power Plants

The cut shows one of our compact and *portable* power plants for driving Crusher Outfits, etc. A complete power plant in itself—durable and efficient. We build different sizes and can meet your requirements precisely.

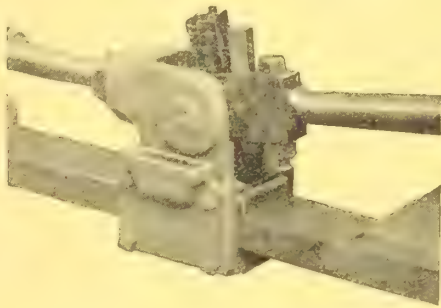
Contractors' Supplies

We also build Boilers, Air Compressors, Engines, Derrick Engines, Hoists of all kinds, Crushers, Screens, etc.

Any of our offices will gladly furnish catalogs and particulars.

THE JENCKES MACHINE COMPANY, LIMITED

Sherbrooke St. Catharines Montreal Cobalt South Porcupine Vancouver Nelson



NO ENGINE CAN DO ITS BEST UNLESS THE CROSSHEAD GIB IS LUBRICATED RIGHT.

The lubrication of so important a part as the Crosshead Gib is too serious to trust entirely to the watchfulness of the operator. Lubrication should be made as nearly automatic as possible, anyway.

On "AMERICAN" Engines the lubrication of the Crosshead Gib has been made practically automatic by bolting to the Crosshead an oil well of large capacity. Felt placed in the bottom of the well prevents sand and grit from getting on the wearing surface and regulates the flow of the oil.

Right lubrication means longer life, better service, no time lost for breakdowns, minimum upkeep. "AMERICAN" Engines are lubricated right.

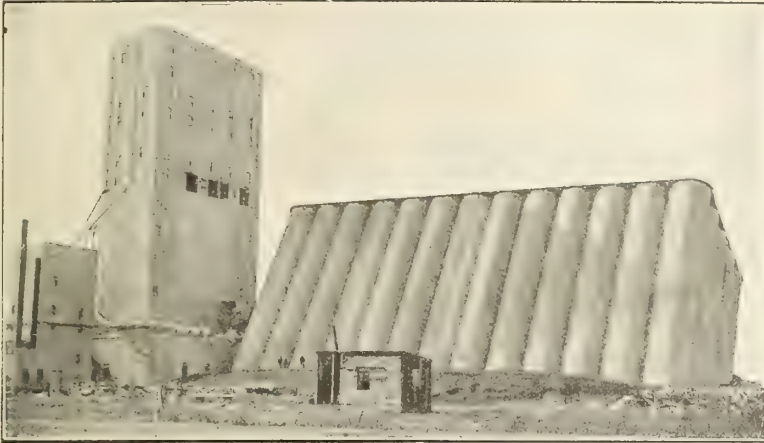
MADE BY

**AMERICAN HOIST & DERRICK COMPANY,
ST. PAUL, MINN., U.S.A.**

SOLD BY

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Gorman Clancey & Grindley, Edmonton, Alta., and Nelson, B.C.

Stuart Machinery Co., Winnipeg, Man.
Vancouver Machinery Depot, Vancouver, B.C.



Views of both sides of the million bushel C. P. R. Concrete Grain Elevator at Transcona, Man., which settled on its foundations to an angle of 30 degrees from perpendicular without injury to the structure or its contents.



Concrete Withstands The Severest Tests—

In the San Francisco earthquake and the Ohio floods, concrete structures withstood the terrific tests of fire, water and vibration without damage.

Now, right in our very midst, comes a striking illustration of concrete's enormous power of resistance and durability.

This great concrete structure, built only to resist the pressure of grain from the inside, while filled almost to capacity with 55,000,000 pounds, or 27,500 tons of grain, settled to an angle of 30 degrees from its original perpendicular position.

In the settling, the walls were subjected not only to the terrific twisting strain of their own weight, but to the weight of thousands of tons of grain as well.

Contract for the restoration of this enormous structure has been awarded to Barnett & McQueen, and it is anticipated that it will be put back into its original position without the slightest injury.

No Loss of Contents

Think of the irreparable loss, had this elevator been built of some destructible material—a material that would have collapsed almost as soon as the settling commenced, and which would have entailed not only the loss of the building, but almost a total loss of its contents.

We have published a number of books which contain the most complete information and beautiful illustrations of almost every use of Concrete (Building, Roads and Pavements) for the architect, engineer, contractor, business-man, manufacturer and everyone interested in a material of such permanence and economy.

These books are free and you may have a copy for the asking—simply state what subject you are interested in, on a post card, and send to

Information Department

Canada Cement Company

Limited

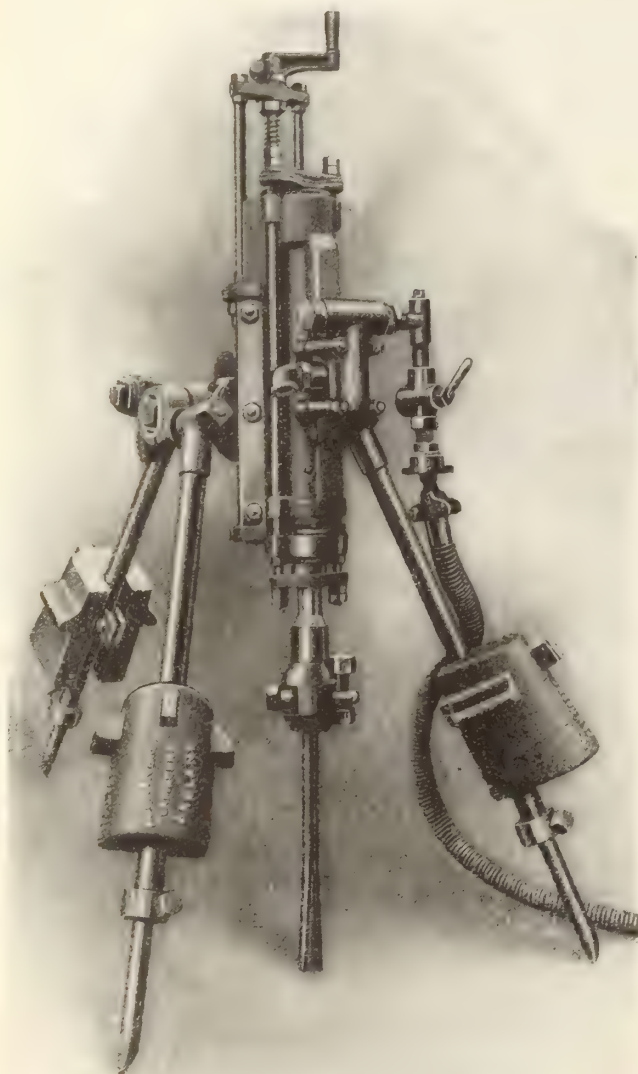
880 Herald Building
Montreal



Sales Offices
at
MONTREAL
TORONTO
WINNIPEG
CALGARY

"PROFITS" ARE LOST

When Rock Drills Are Laid Up for Repairs



When a drill is idle owing to repairs you not only lose the cost of the idle labor and the cost of repairs, but you lose the footage supposed to be made by the drill.

Loss of this footage can never be recovered.

The drill that stays on the job is the profitable drill for you.

HOLMAN STEEL ROCK DRILLS

are the most economical in repairs. They are an all steel machine intelligently constructed, built by men who are miners as well as drill manufacturers.

Carried in Stock.

Catalogue Furnished on Request.

Mussens Limited

MONTREAL, 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine

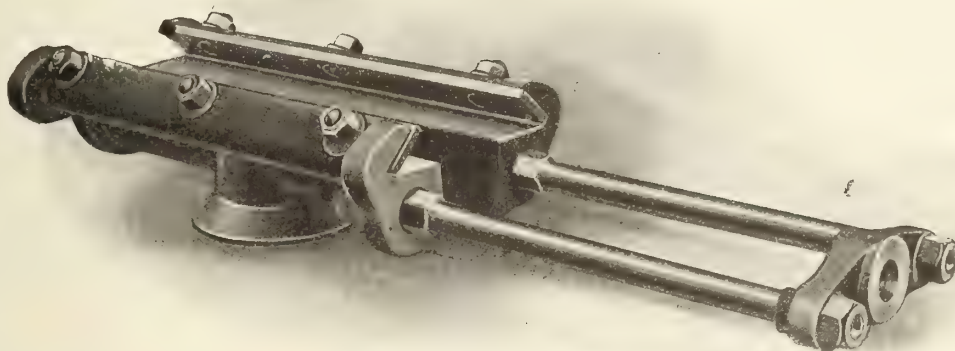
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CALGARY, 10th Ave and 3rd St. East
VANCOUVER, 101 Water St.

QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

COMPARE THE CRADLE

of the HOLMAN STEEL ROCK DRILL

with the ordinary type



The Holman Cradle

Note the ease of adjustment for taking up wear.

Note the guides of the cradle are V-shaped, not square.

With ordinary cradles the cylinder slides are sure to get loose, causing racking and loss of efficiency.

To end such a loss it is necessary with this ordinary bolted shell cap type to replace with a new cradle or cylinder.

Compare this cost with the cost of taking up the wear on Holman Cradles. This is one of the advantages of the

HOLMAN ROCK DRILL

The Drill You Will Finally Buy

Mussens Limited

MONTREAL 318 St. James Street
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine

WINNIPEG, 259-261 Stanley Street
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- Hydrants**
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company

(Continued on page 12)



Residence of W. W. Butler, Cote St. Antoine Road, Montreal.
Robt. Findlay, 10 Phillips Place, Architect.

Don Valley Brick

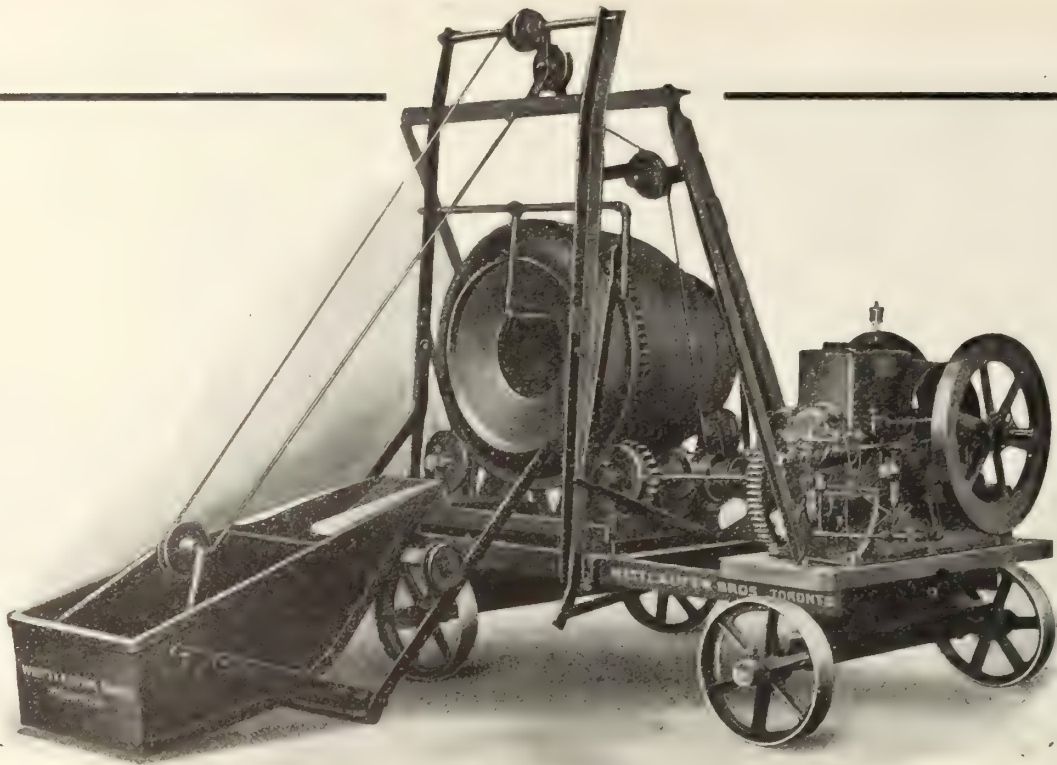
FOR the largest buildings, the finest residences and brick work in general Don Valley Brick stands pre-eminent.

The illustration shows a handsome Montreal residence in which Don Valley Bricks were used. The resultant rich effect of the brick work thoroughly justified the architect in specifying "Don Valley Bricks."

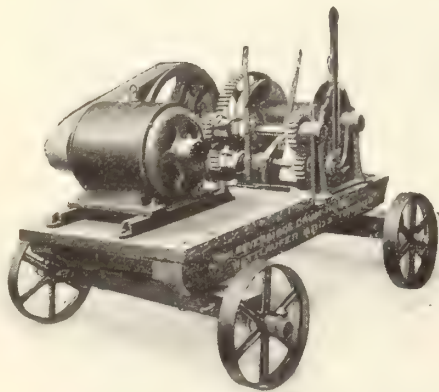
Don Valley Porous Terra Cotta Fireproofing is used for fireproofing most large buildings.

Don Valley Brick Works

Toronto, Ontario



Mixers and Hoists

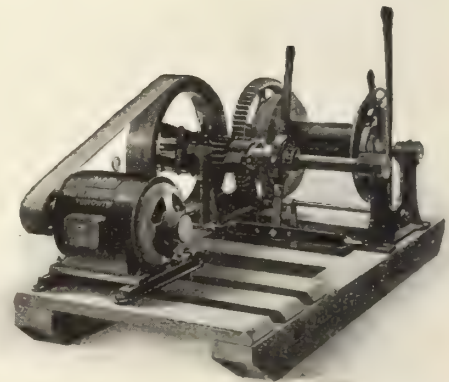


When it is time to buy new equipment be sure and examine the Wettlaufer line of Heart Shape Drum Mixers and Hoists.

Wettlaufer Mixers are famous the country over for their thorough mixing.

Wettlaufer Hoists are made in fourteen different types and sizes.

Attend a daily demonstration at any branch.



Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

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A. E. Hodgert, Regina, Sask.; Maysmith & Lowe, 1057 Mears St., Victoria, B.C.; A. R. Williams Machinery Co., 15 Dock St., St. John, N.B.; The Canadian British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man.; R. F. Mancill, 117 10th Ave. East, Calgary; The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C.; J. L. Lachance, Ltd., 363 St. Paul St., Quebec; Wettlaufer Bros., 316 Lagachetiere St. W., Montreal.

Cement and Crushed Stone

For difficult concrete construction where the highest quality cement and sharp clean stone are required we ask you to specify Rogers.' Our cement will stand all your tests.

125' x 5' reinforced concrete chimney. Built for the Dominion Cannery Co., Limited, by The Weber Chimney Co., Chicago.

Rogers' Cement used.



Alfred Rogers
Limited
28 King Street West
Toronto

MILLS AT
St. Marys
Hanover
Kirkfield
Orangeville
Owen Sound

QUARRIES AT
Vinemount
Dundas

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

VITREOUS FACE BRICK



OUR BRICK SHOWROOM IN MAIL BUILDING

Astrakhan Brick

Bokhara “

Kushequa “

Moquette “

Shawnee “

Turkestan “

**Rough and Smooth
Surfaces**

**Salt Glazed, Enamel
and Paving Bricks**

**Selected Fireplace
Brick Carried in
Stock**

BLACK BUILDING SUPPLY CO., LTD. - TORONTO

LONDON CONCRETE MACHINERY

to suit all classes of work

Gasoline
Engines

Pumping
Outfits

Steam and
Gasoline
Hoists

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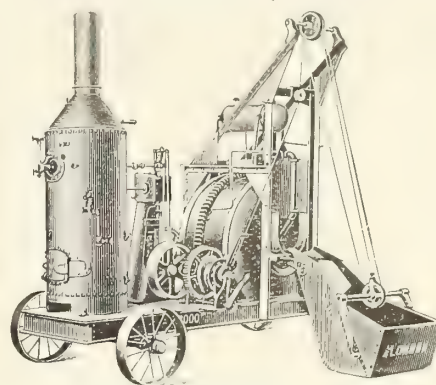
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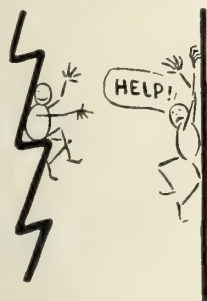
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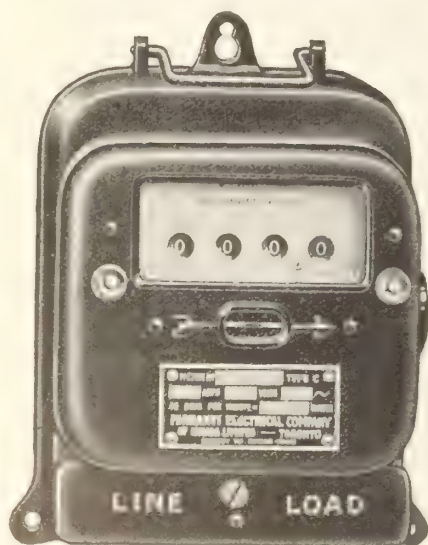
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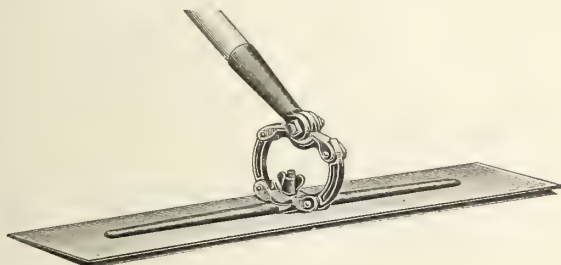
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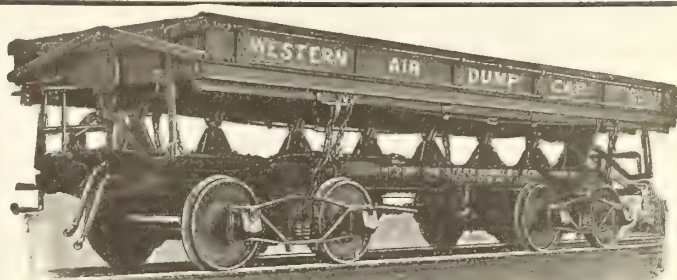
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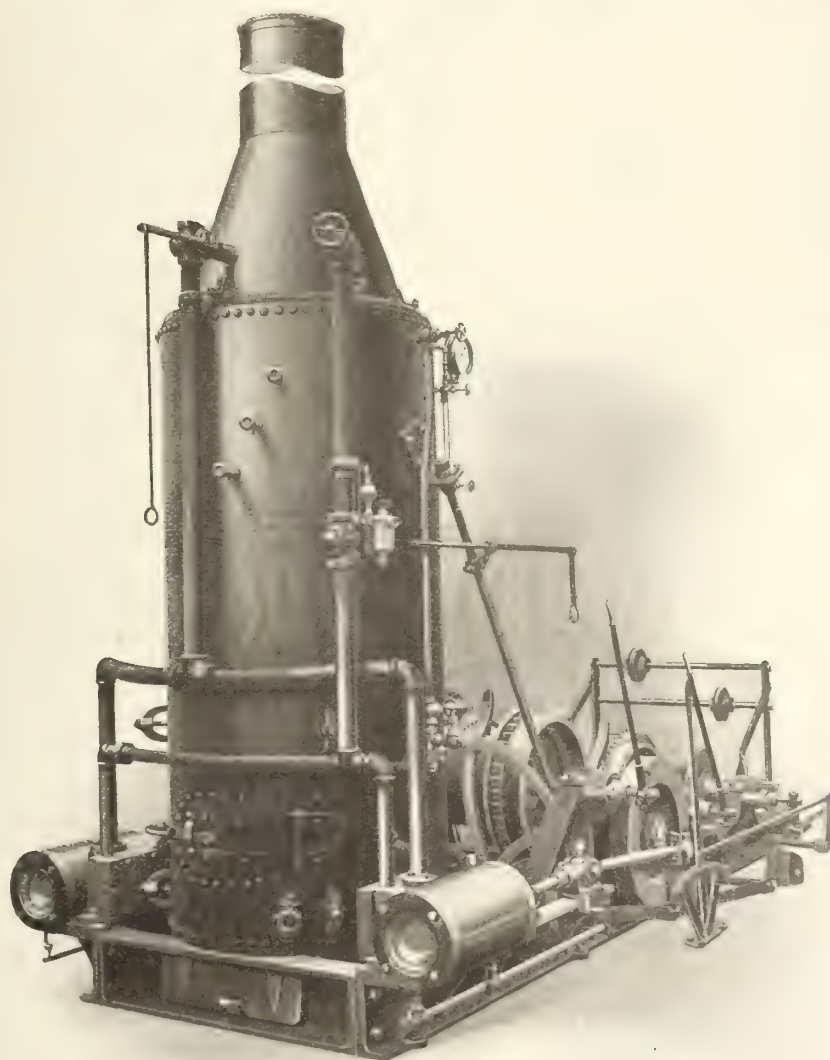
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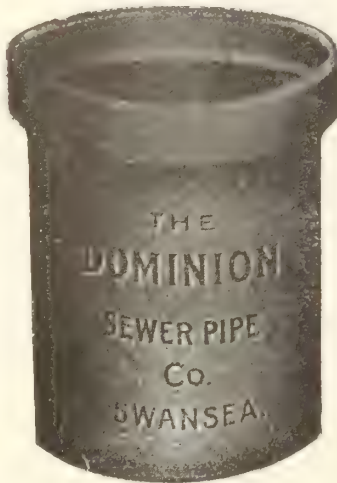
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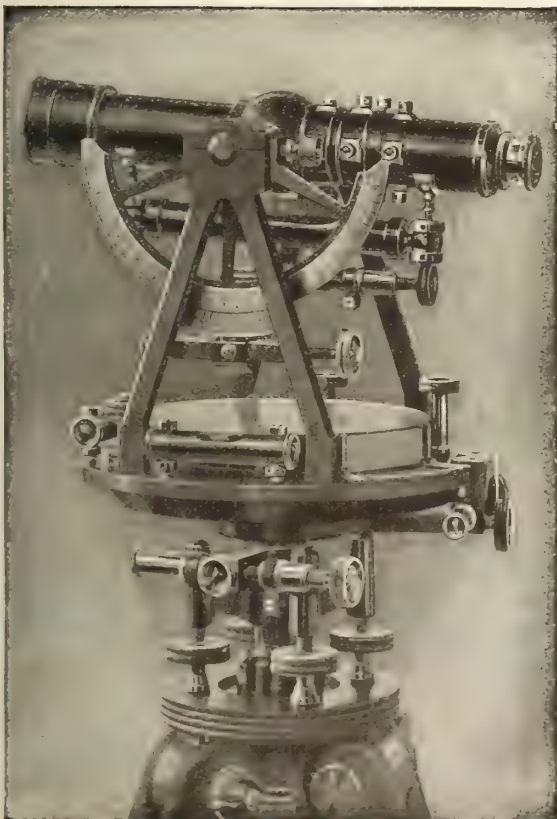
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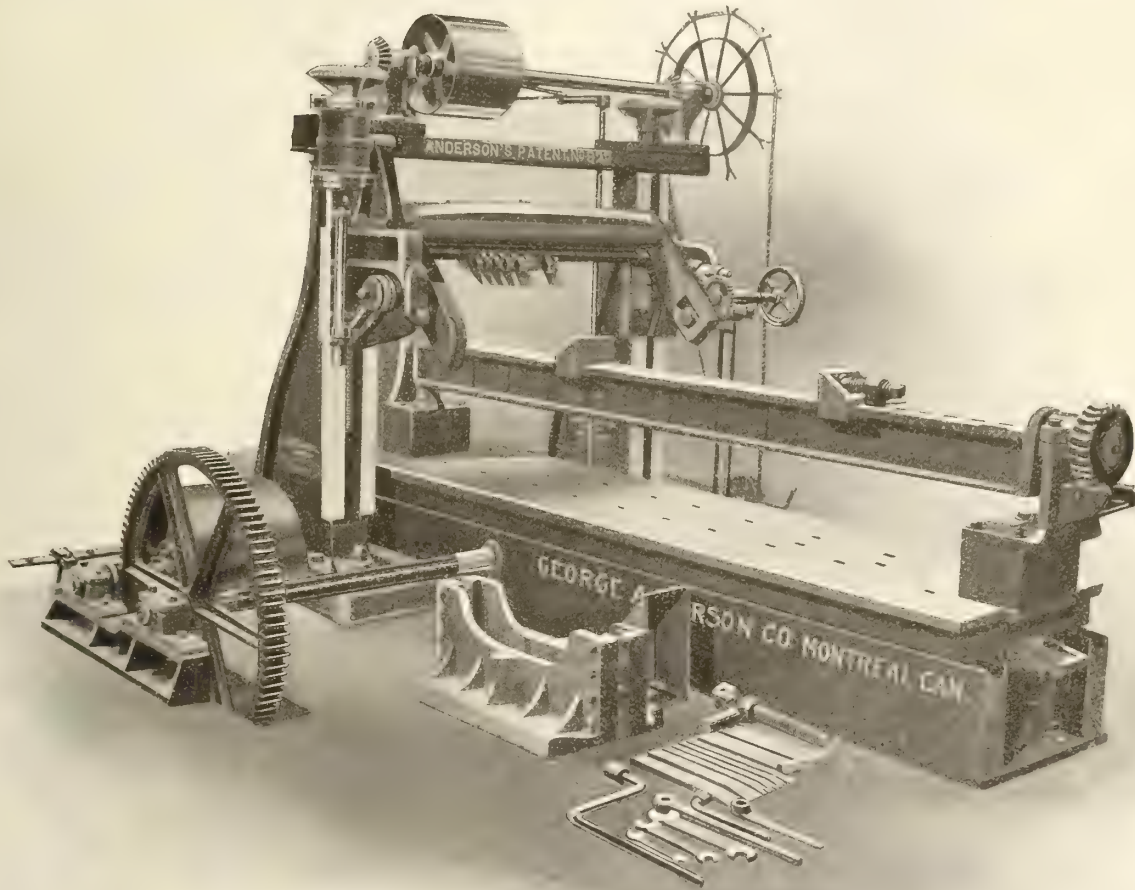
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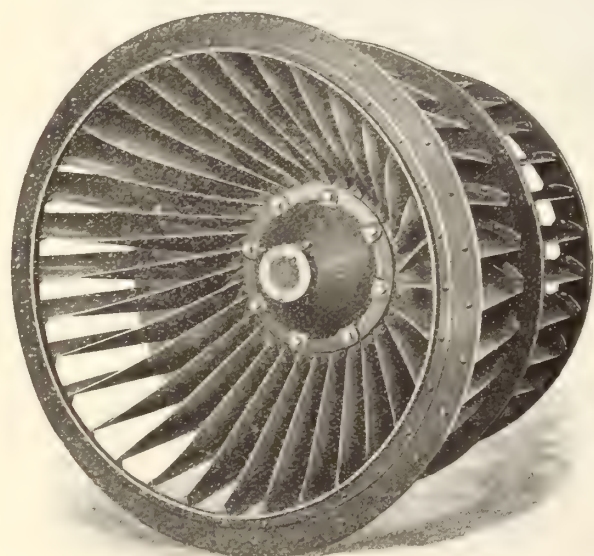
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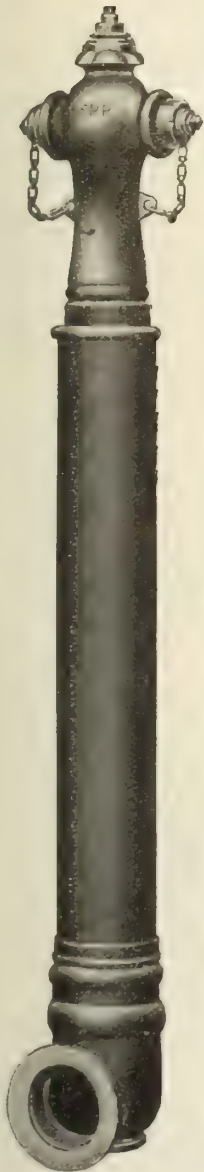
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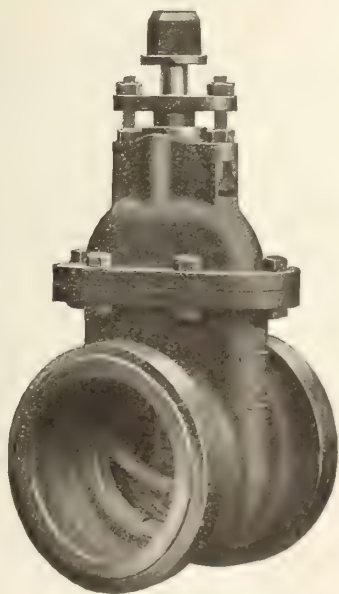
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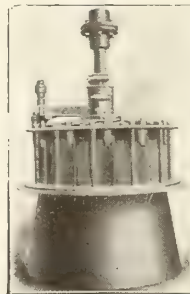
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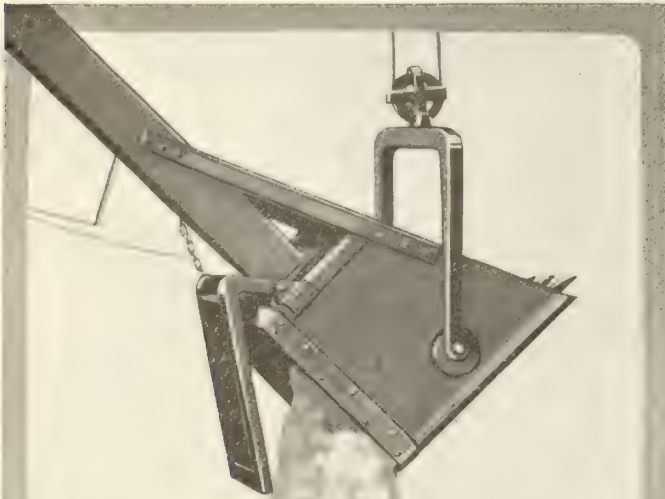
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- Concrete Costs, by Frederick W. Taylor. Published in 1912 by John Wiley & Sons, New York. 696 pages; illustrated. Price \$2.00.
- The Concrete House and Its Construction, by Maurice M. Sloan. Published by Association of American Portland Cement Manufacturers in 1912. 224 pages; illustrated. Price \$1.00.
- Sewage Disposal in the United Kingdom, by Henry Lemmoine Cannon. Published in 1912 by St. Bride's Press, London, Eng. 320 pages; illustrated. Price \$1.00.
- A Manual of Technical Plumbing and Sanitary Science, by S. Barlow Bennett. Published by Author in 1911. 284 pages; illustrated. Price \$1.00.
- Brayton Standards—A Pocket Companion for the Uniform Design of Reinforced Concrete, by Louis F. Brayton. Published in 1906. 110 pages. Price 50c.
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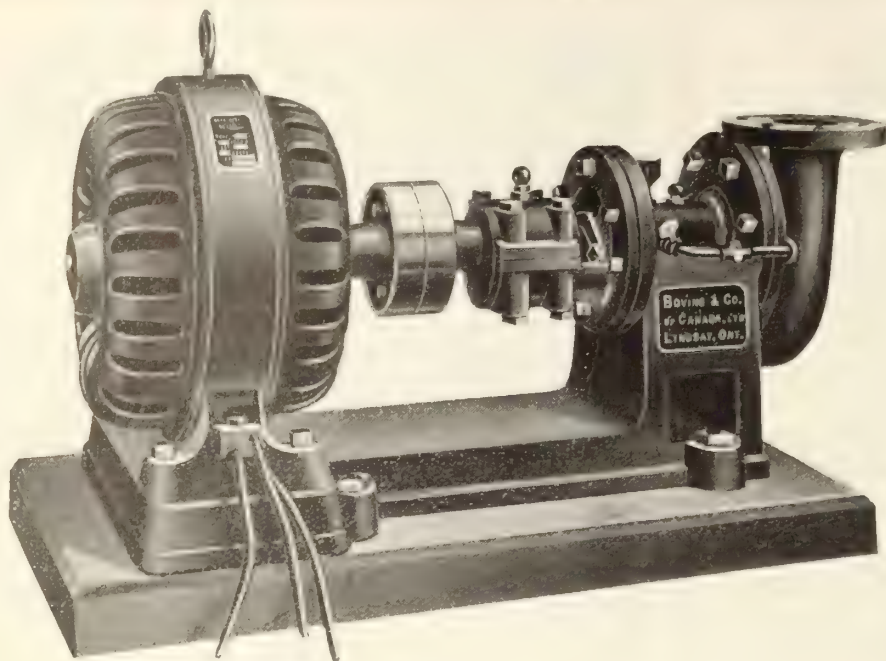
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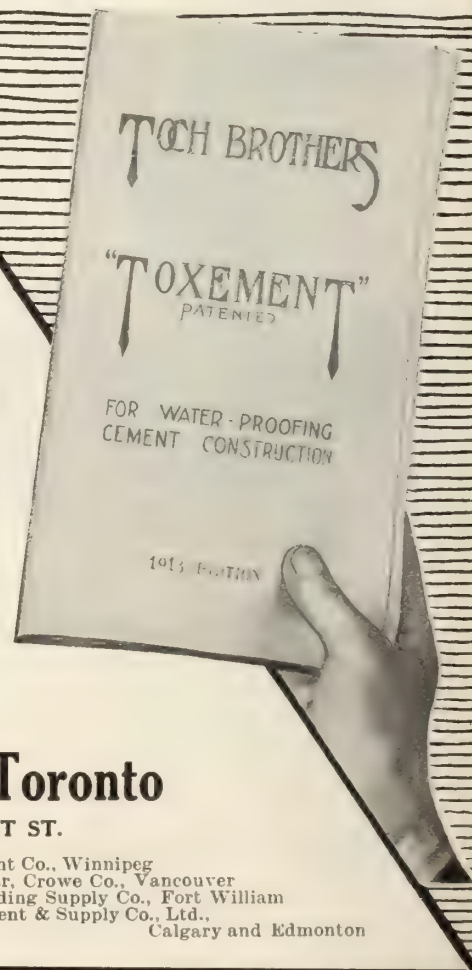
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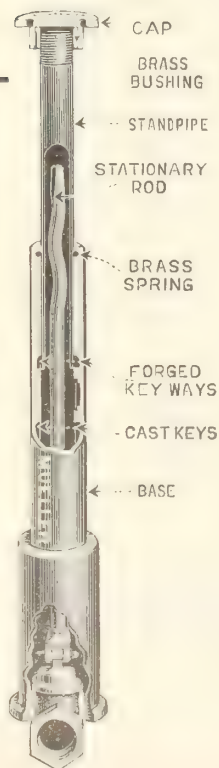
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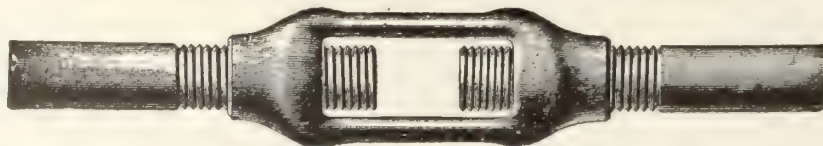
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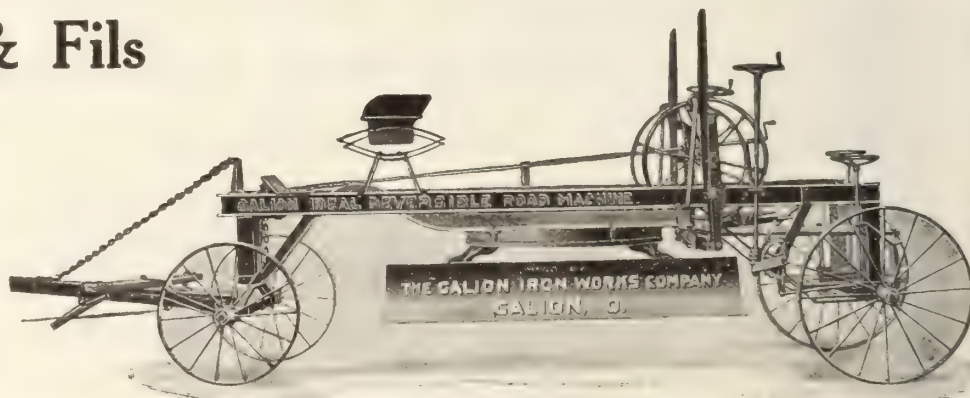
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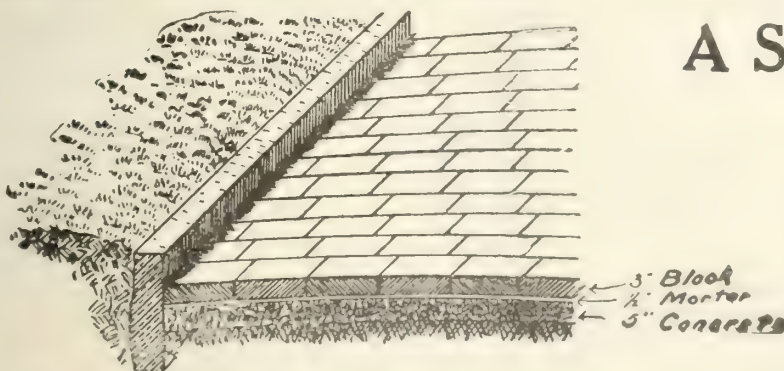
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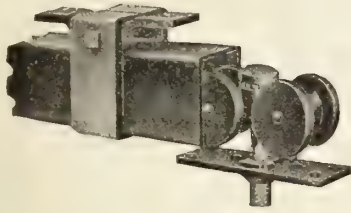
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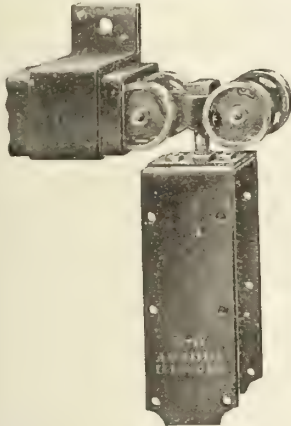
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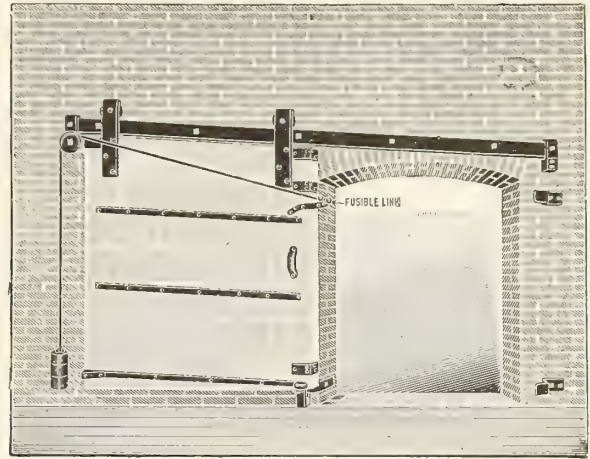
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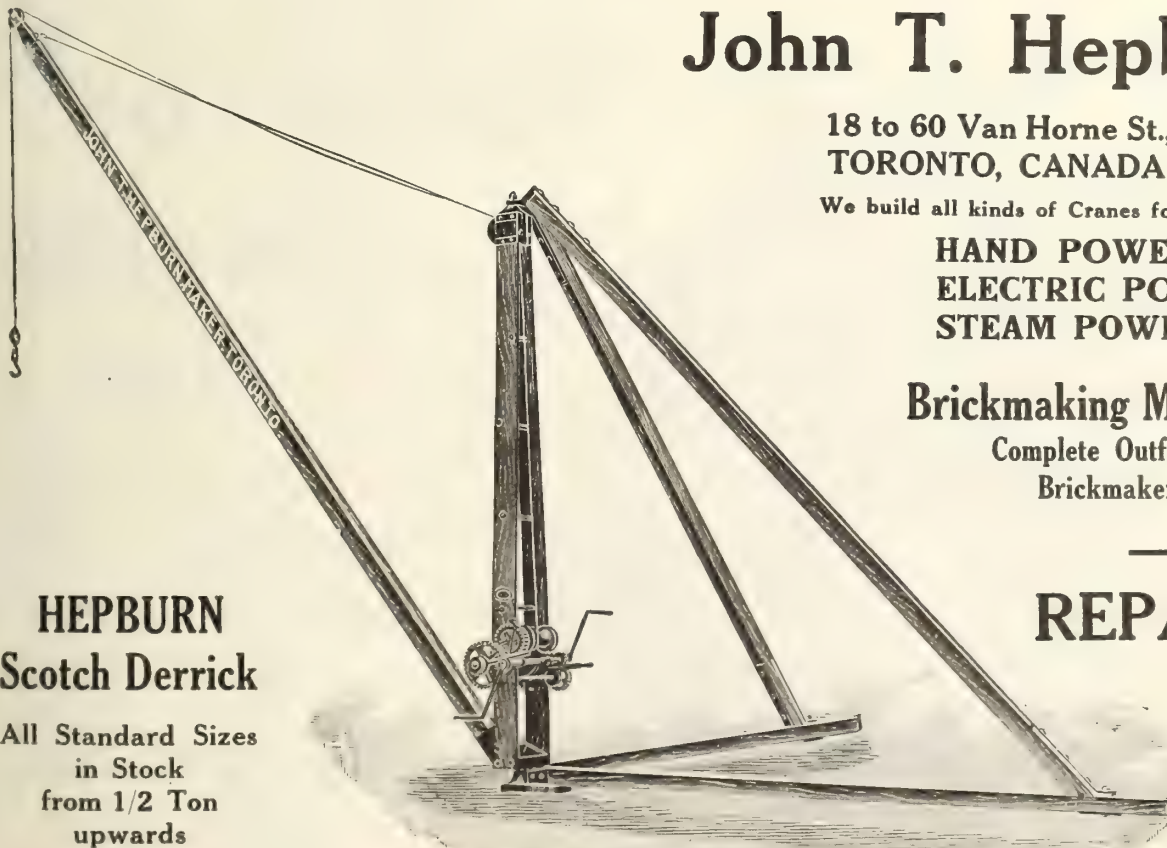
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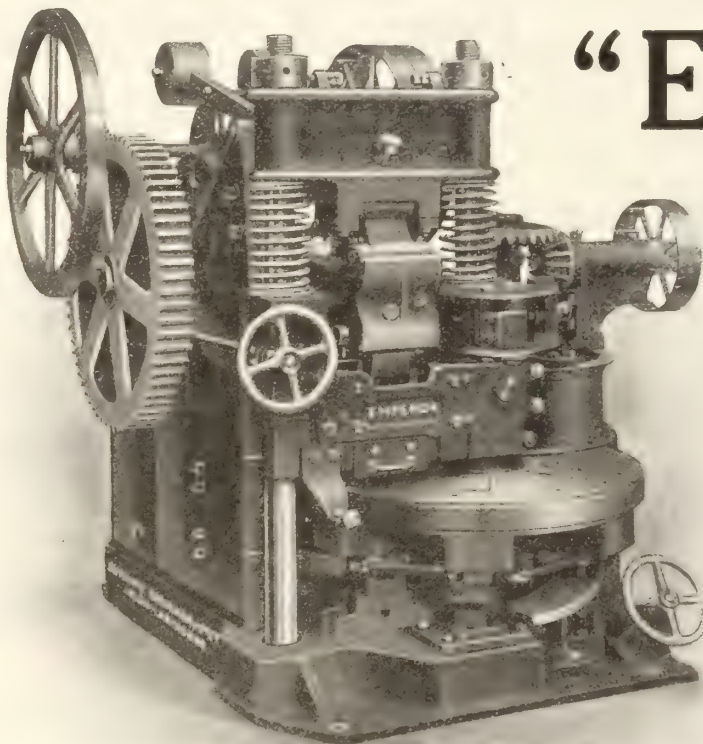
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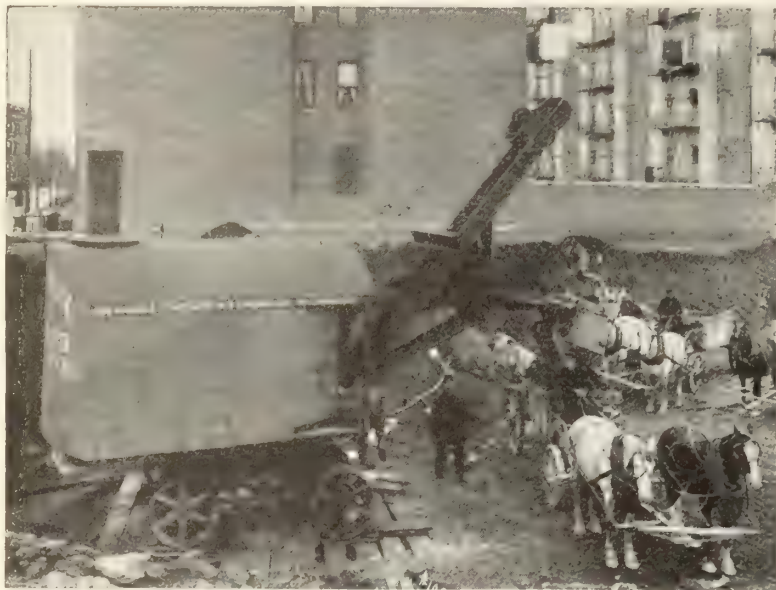
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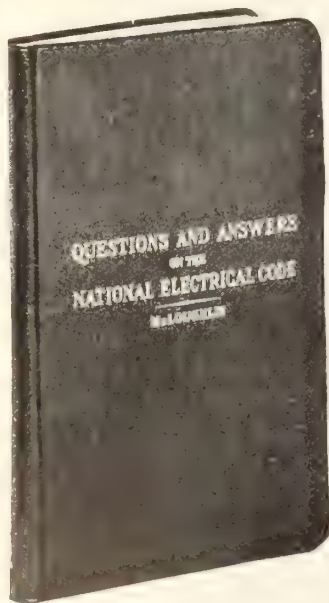
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TORONTO

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"Robbing Peter" and Like Procedure

THE folly of such procedure in estimating as "robbing Peter to pay Paul" forms the subject of an interesting letter contributed to this issue by a prominent Winnipeg contracting concern. In the main the letter constitutes a plea for a higher standard of ethics—not only for the contractor, but also for the engineer and the owner. The basic principle established is that competitive tendering is a "competition" only to the extent of securing from contractors figures computed according to a common standard. It is opposed to all fairness, and it militates against the best interest of everybody concerned, to take competitive bidding at its lowest appraisal—as a scheme for luring contractors into submitting bids which entail either loss or a bare clearance.

We hear a great deal about scamped operations and inferior material in public works, but is not much of this due to a mistaken idea prevalent in some quarters that in dealing with contractors it is a good policy not to "do unto others. . . .," but to do others before they get a chance to do you?

Doubtless our correspondent's argument will appeal to those who are interested in the broad, constructive work of raising contracting standards.

The City Manager Plan

THE city of Dayton, Ohio, is entering upon an experiment the result of which, in regard to its relative efficiency, will provide many cities on both sides of the border with material for careful reflection. At Dayton an experienced civil engineer has just been appointed to the office of City Manager. As at Staunton, Va., and other cities, this official will have authority over all public works and will be held responsible for expenditures. He will defer to council only on matters of general municipal policy. In favor of the commission plan of government on these lines it is argued that it is possible to manage a city just as a private business is controlled by a board of directors and a general manager. Under a city manager of the type that has been appointed at Dayton the development of a city proceeds with due regard to engineering principles. Where a town is too small to have a regular city engineer the city manager plan has many advantages, but upon a revised and enlarged scale it would appear to apply to the large cities. A discussion of the scheme put into effect at Dayton, Ohio, would be timely following upon the editorial article, "Engineering Responsibilities and Lay Administration," published in our last issue.

"My Greatest Mistake"

OUR esteemed contemporary, Engineering and Contracting, publishes in all seriousness an editorial article under the heading, "Should Engineers Describe Their Failures as Well as Their Successes?" This recounts how two prominent engineers were discussing the subject-matter of the general run of articles in engineering papers and how it was agreed that it would be of great value to the profession if a series of letters could be published under the general caption, "My Greatest Mistake in Engineering Practice." Our contemporary, while doubting the practicability of such a scheme, commends it on a modified basis and states that it is in-

cumbent upon a man who has published a description of one of his designs to make public later the nature of any considerable shortcoming revealed in that design after it has been placed in use.

To our mind this provides a rich and rare exemplification of what is all right in theory but poor in practice. Imagine the reminiscences of a score of our leading Canadian municipal engineers published in book form under such a heading as that suggested! In the first article City Engineer Brown would tell how he made a mess of the water supply at Hogtown, and in the second City Engineer Jones would narrate how he wasted thousands of dollars in under-estimating the

requirements of the city's sewerage department. Records of failure written in a general way are well enough handed down from the last generation, but we live in an age when nothing counts like success. However much we might profit by the mistakes of others, to advertise our shortcomings as designers and constructors would be inviting the fate of the dog who after being given a bad name came to the ignominious end of hanging. There may be one or two outstanding geniuses in the engineering field whose records would survive any publicity given to their greatest mistakes, but it would spell FINIS to the professional career of the rank and file in the engineering community.

Excessive Self-Confidence in Engineers

EVERY virtue carried to extremes becomes a vice. Self-confidence, which is essential to all success, often degenerates into a pure egotism that presages failure. The training that the modern engineer receives is one that is rightly planned to give a feeling of self-assurance, but we fear that, at least in many instances, too great self-assurance exists among engineers. The evidences? Several, but two will suffice.

Consulting engineers are in comparatively slight demand for most kinds of engineering work. Take railways for example. Where are the Wellingtons—the consulting experts in the economics of railway location? Where are the consulting experts in railway operation? Scan the pages of “professional cards” in engineering periodicals and come to a better realization of the fact that there is virtually no demand for consulting engineers in railway location, construction and operation. Is it because every railway has already all the best experts available? One might easily think so if one were influenced by the evidence of lack of demand for consulting experts.

Turn now to highway engineering. Here we find a few—a very few—names of consulting engineers. Can it be that every city engineer and every county engineer is already a past master in the art and science of highway economics? One might infer as much from the general indifference to outside engineering advice, unless that advice is gratis.

Once there was quite a large array of names of consulting bridge engineers. Gradually the list has dwindled. Is this also due to universal knowledge of bridge economics? We fear that many an engineer has mistaken a knowledge of all structural economics, and has greatly underestimated the difficulty of designing the most economic bridge for a given condition. When we consider that hundreds of millions of dollars are annually spent in every large branch of engineering, and when we note how scarce are the names of consulting engineers even in those branches where advice is most commonly sought, we are startled by the evidences of hyper-confidence to be found on every side.

Self-confidence is not the only factor that operates to reduce the ranks of consulting engineers. Many employers have yet to learn that the profession of engineering differs from that of law and medicine. One attorney or one doctor is all that the average man feels he can afford to handle his case. It is yet to be learned that more than one engineer can often be profitably employed to direct an engineering “case.” But

how is this fact to be learned by employers? Surely not by our keeping silence. Either self-confidence or timidity, then, is at the bottom of the general reluctance of engineers to ask for the advice of consulting engineers.

Another evidence of the existence of too much self-confidence is to be seen in the relatively slow and small sale of engineering books and in the scanty libraries of most engineers. Taking even the best engineering treatises—those commended highly by reviewers and purchasers—we find that the sales are much below the known number of those who could profit from the books. Go into the office of any lawyer and look at the shelf upon shelf of books. The four walls of his office are book filled. Then go to the office of an engineer. Eliot's “five-foot shelf” will ordinarily hold all the engineering books there and yet remain partly empty. Making due allowance for the difference between the practice of precedent and the practice of science, the meagerness of the average engineer's library is noteworthy. The lawyer, it is true, gains more and larger fees in proportion to his success and therefore has a strong incentive to leave no means unused to win. Hence the great store of precedents and statutes that he accumulates for his guidance. The engineer, it is true, commonly gains little more in salary because he saves money for his employer—an employer who, by the way, can seldom recognize engineering economy when he sees it. Yet is it not a mistaken policy that leads the engineer to curtail his expenditures for literature?

But even in those offices where the employer could easily be persuaded to buy all needed engineering books and to have files of bound periodicals we seldom see an adequate engineering library. How many railway companies, for example, have an engineering library worthy of the name? Is the absence of engineering treatises in the libraries of such companies an evidence of parsimony? If so, it speaks ill of the persuasive powers and the standing of the engineers in the employ of the companies. We think, rather, that the main reason is a deeper one. We believe that many engineers are prone to solve most of their problems with the aid of a “pocketbook” and a slide rule.

Where have we engineers acquired these habits of hyper-confidence? Largely, we think, in the school room. Starting as small boys, we have been trained to glean nearly all our knowledge on one subject from one book, and to use that one book for nearly all reference purposes. Unfortunately, too, that one book has rarely given a hint that it contains only a small

fragment of the total published knowledge on its subject. Seldom does a text book introduce the two sides, to say nothing of the many sides, of a controversy—and what scientific subject other than mathematics is not open to debate? Then, also, the text books tend to exalt “principles” and to make light of the mass of “confusing facts.” The habit of reasoning from established principles is rightly formed, but the equally important habit of consulting all the important data with which to reason is not formed at all at our schools, and seldom at our engineering colleges. Yet, of two men, the one a trained logician and scientific analyst, and the other poorly trained in formal reasoning, which would it be the safer to choose to solve an engineering problem, assuming the first man to be no digger for data and the second to be most thorough in his search for facts?

Most of the errors in reasoning are not due to improper ratiocination but to inadequate data.

This is true of all forms of reasoning. It is true in marked degree of reasoning on matters of economics and that includes engineering. As for inductive reasoning, it is self-evident that many data must be gathered before correct theories or generalizations can be formulated, but it is not always appreciated that for correct deductive reasoning—ratiocination—it is also imperative that many data be available. A correct formula is of little use if suitable constants be not used in its application.

When we part from that small area of engineering practice where formulas are applicable and enter that boundless tract where art is more in evidence than science, we should be even more impressed with the desirability of having at hand a wealth of examples and recorded results of experience. How pinched then looks the self-secured knowledge of any individual. How barren the best of text books written primarily to impart principles.

Teachers, as we have frequently remarked in the past, have acquired a habit of overlooking the importance of drilling correct habits into their pupils. It does not suffice to train a pupil in deductive reasoning and to give him practically no training in the all-important practice of research. The problems of everyday engineering bear little relation to a “final examination” where memory and reasoning power must alone serve.

Perhaps the worst indictment that a young engineer can have from an employer is one that pronounces him careless. This does not mean merely that his addition or multiplication fails to be correct. A graver and more common carelessness is that which may be called lack of thoroughness; and it is this form of carelessness that is apt to show most prominently in a man who has been drilled mainly in deductive reasoning. It were better that an engineer were trained to thoroughness in research at the expense of thoroughness of mathematics, than that the reverse be true. Yet the reverse is usually true.

Most of the celebrated consulting engineers are men of great thoroughness. Few stones are unturned by them when a new problem arises. They can reason no better than many of their assistants, but they can and do go farther in their search for facts with which to reason. They travel over many states and countries, searching for facts. They accumulate large libraries of their own, and they make constant use of still larger collections of engineering literature. Theirs is the function to be thorough, and in this thoroughness alone lies most of their success. Often berated for poverty

of personal experience, they are rich in the experience of others which they have made their own. What a pale, small candle flame is the personal experience of any man when brought before the sun of the great experience of humanity? And this vast sun, what is it? An immensity composed of specks—a stupendous integral of infinitesimals. Facts are to the reasoner what the sun's rays are to the plant. No idea can grow in the absence of data. To display self-confidence where data are meagerly known is to give evidence of unbalanced training, yet many a recent graduate engineer is thus confident, nor are his elders entirely blameless in the same score.—Engineering & Contracting.

The Part of the Electrical Industries in Canada's Future

FUTURE Prospects formed part of the subject of an illuminating address delivered recently by Mr. Frederic Nicholls, President of the Canadian General Electric Company, Limited, at a meeting of directors held to commemorate the 25th anniversary of a syndicate whose extensive operations are now conducted under the firm name which is so frequently abbreviated into “The C. G. E.” After giving the history of the company, Mr. Nicholls stated in part:

“I do not desire to pose as a prophet, for the reason that our own future must run parallel to the future development of our country. Personally, I have the utmost faith in the future development and continued prosperity of Canada. Occasional set-backs we must expect, but the march of progress must be always onward, as so much of our great country still remains to be developed and populated. Next year, two new transcontinental railways, the Canadian Northern and the Grand Trunk Pacific, will be in operation for the first time, operating through trains from the Atlantic to the Pacific. The Canadian Pacific Railway have increased their trackage, rolling stock, and other facilities, at an expenditure equal to that required to build a new railway from ocean to ocean. The contracts for the new Welland Ship Canal have been let by the Dominion Government. Public works of great magnitude are either under construction or being projected by the Federal and Provincial Governments. Up to the present our immigration has continued to increase, so that, taking it all in all, the future is full of promise, even though for some short while we may experience a recession in trade, as a result of the present world-wide financial uncertainty.

“Mr. F. A. Vanderlip, President of the National City Bank of New York, an authority on financial and trade statistics, in a recent address, made the statement that the intelligent development of the electrical industry in the United States will readily absorb for the next five years, \$400,000,000 a year, or \$8,000,000 a week.

“I do not predict that in Canada our percentage of trade, on a pro rata population basis, will be so startling, but there is no reason why we should not expect a satisfactory growth in the demand for our products.

“A normal growth of population may be counted on. The trunk line railways will undoubtedly electrify certain sections, such as terminals and mountainous divisions, and I am pleased to say that the first two important contracts that have been let for the electrification of steam railways in Canada have been awarded to this company. I refer to the electrification of the Rossland-Castlegar division of the Canadian Pacific Railway in the Rocky Mountains, and the electrification of the tunnel under Mount Royal, and the Montreal Terminal, for the Canadian Northern Railway.

“In considering the future uses of electricity in Canada, we must have in mind the impetus this industry has received

as a result of the utilization of our magnificent water powers. Few realize that from Quebec in the East, to Victoria, British Columbia, in the West, nearly every city, town and village has the advantage of hydro-electric power for its lighting, its street railways, and its industries. Quebec, Montreal, Ottawa, Toronto, London, Port Arthur, Fort William, Winnipeg, Calgary, Vancouver, Victoria, and intermediate points, are all operating electrically, and our reserves of water powers undeveloped will serve the needs of the country beyond our time."

Clay-workers to meet Next Week in Toronto

THE Twelfth Annual Convention of the Canadian National Clay Products Association, formerly the Canadian Clay Products Manufacturers' Association, will be held at the King Edward Hotel from Tuesday to Friday, January 27-30. The president of the association is Mr. Chas. A. Millar, Toronto (a valued contributor to the Contract Record) and the secretary Mr. John R. Walsh, of Toronto. A number of interesting papers are scheduled for presentation at the meeting. The authors include several gentlemen well-known to readers of the Contract Record—Mr. Joseph Keele, of Toronto; Professor M. B. Baker, of Kingston, and Professor Day, of Guelph, for example. It is hoped to make the meeting as valuable as possible from the technical standpoint, and the papers and discussions will cover practically every phase of the industry and deal with everyday difficulties in operation. On Friday evening a unique entertainment will be given at Park Theatre, where, in addition to the regular vaudeville and picture show, there will be films showing brick plants, brick roads and other views of special interest to the trade. It is of interest to note that Park Theatre was erected by a former President of the Association, Mr. D. A. Lochrie, and that it is managed by a man named S. M. Brick.

Particulars as to membership in the Association and further details concerning the coming convention may be obtained on application to the Secretary, Mr. John R. Walsh, 40 Blake Street, Toronto.

A reinforced concrete crane-pontoon, 30 m. long by 13 m. wide, fitted with a motor and screw, and capable of being navigated by its own power, has been constructed at Marseilles. It is to carry a crane 10 m. high, with an overhanging or unsupported length of 10 m., able to support a load of 30 tons. The pontoon has double sides, protecting it against the influx of water should the outer skin be damaged.

Whilst excavations were being made for the drains for the new gymnasium in the course of erection in the grounds of the Simon Langton Schools, Canterbury, Eng., the workmen unearthed a good specimen of a Roman tessellated pavement. Unfortunately, before they realized the value of the find, the mosaic had been considerably damaged by the pick. Excavations on four previous occasions in the school grounds have reached, at a uniform depth of 7 ft. from the present surface level, similar portions of tessellated pavement, the last occasion being some seven years ago. The original buildings of the monastery of the White Friars were evidently built on the site of a Roman villa.

The Purchase of City Supplies

SOME valuable observations on the purchase of city supplies are made in a report by E. C. Church on the organization and administration of the Supply Bureau of the Department of Water Supply, New York. The system employed in this department is of such a high order that the operations of the Bureau are practically automatic. Mr. Church is Secretary of the Department and Chief of the Bureau of Supplies. The fundamentals which he lays down are based upon a most commendable combination of successful experience and common sense. Following is an abstract of his report:

All supplies ordered and bought should be really necessary and should be those best suited to the use to which they are to be put. It frequently happens that large sums are wasted by calling for materials far too expensive and of too high a grade for the purpose intended. Again, it sometimes happens that poor material is bought because it is cheap, whereas a better and more costly article would have rendered proportionately for more service. To obviate this, standards and written specifications are recommended so that the most suitable supplies may be bought and the same article used for the same purpose throughout the entire department.

The precise quantity needed should be ordered. When a man leads a hand-to-mouth existence, continually ordering small quantities of material, he puts the purchasing division to a lot of expense, as it costs nearly twice as much to handle a small order as a large one. The cost of delivery is away out of proportion to the size of the shipment and the necessity for inspecting each lot increases inspection costs. On the other hand, when told to do a piece of work most men "get on the safe side" and order far more material than close figuring would show to be necessary. This is particularly true where the machinery of purchasing is cumbersome. A man hates the bother of making out another order for additional stock. If more material has to be purchased and there is much red tape he may have to wait a long time and the job will be delayed. Quantities should be checked and men held responsible for extravagant requisitions. Interest on investment, depreciation and other losses must be reckoned with.

Purchases should be made in accordance with a definite plan and under most favorable market conditions. It frequently happens that a half dozen requisitions to purchase some standard material are sent in one at a time during the course of the year as the various projects develop on which the material is wanted. Ordering supplies in this manner is unsatisfactory. It greatly increases the office expense for purchasing, it prevents the combination of similar requisitions in order to obtain wholesale prices, and the fact that immediate delivery is generally demanded makes it impossible to wait for favorable markets before buying.

One improvement is that a large proportion of the supplies now bought are ordered in advance and instead of being delivered direct to the consumer are consigned to the nearest storehouse, where they are inspected and stored and later delivered from stock as called for on requisition. In this case the stores act as distributing depots.

Fixing Limits of Stock

The amount of money invested in material should be kept at a minimum. Fixing the limits of stock to be carried is most important. In order to know the proper amount of stock to keep on hand, the chief of the bureau of supplies should be in close touch with the work of the department as a whole, and with the details of that "program," before referred to, which is supposed to regulate all activities. He should know of all new work and all contemplated improvements a sufficient time in advance to purchase the required supplies in a favorable market, and to have them delivered, inspected

and ready when needed. He should be informed concerning the amount and nature of materials necessary to be kept in reserve at certain points for various emergencies. He should be fully posted regarding the stores required for current operating purposes, and any changes in "policy" which will affect the same. Using these facts in connection with the data on the time required to obtain or replenish stock by purchase or transfer makes it easy to calculate the minimum quantities of stock to be kept in storage.

The question of the proper amounts of emergency equipment, spare parts, tools, implements and current supplies to be maintained by the operating divisions is most important, though apparently it has not yet been standardized.

Materials should be properly stored and issued. It has always been considered a grave error in organization to place the control of materials and supplies, in large quantities, in the hands of the men who use them. The bureau has insisted that it should store all materials and supplies prior to issue, under the care of responsible men especially detailed to that work. With this end in view, it has always assumed charge of storage points whenever permitted to do so. The economy in consumption and diminution of waste effected by this control has been remarkable. The previous improper methods of storage and accounting for supplies have become apparent as the various storage points have been placed under the jurisdiction of the bureau. Rules for the care and storage of supplies after issue from stores and while in the hands of the ultimate consumers should be prepared and enforced.

Supplies should be put only to the use intended. This is a matter only partially within the control of the bureau. Purchasing agents can assure themselves that goods bought are suitable for the requirements, and storekeepers can report when goods requisitioned out of stores are not suited to the ostensible use to which they are to be put, as stated on the order. They can also prevent deterioration in stock and loss from theft, which certainly do not come under the head of "use intended."

Supplies should be used efficiently and economically. No matter how careful and saving the bureau may be in the matter of purchase, inspection, storage and issue of supplies, if the men using the material use it inefficiently or wastefully it will soon give out and have to be replaced.

Supplies should be kept in service till they are worn out or changed conditions require the substitution of a more efficient or more economical article. Loss is often incurred by premature replacement of materials. To the cost of the new article must be added the cost of the replacement plus the remaining value of the article replaced, which can seldom be used elsewhere.

Unnecessary Restrictions

All useless, burdensome and foolish restrictions and conditions should be removed from the bidding requirements and the specifications. The city's business should be made as attractive to possible bidders as is that of any of the great private corporations. On the contrary, doing business with the city is now fraught with many needless annoyances and restrictions. Many of the conditions so imposed cause the contractor actual expense, while others merely introduce elements of uncertainty and possible loss against which he must protect himself by increasing his bid proportionately. All such restrictions, whether actual or potential, are ever present handicaps to proper economy.

Some of the conditions are imposed by law; others are the result of bad purchasing methods, improperly worded specifications, inefficient office procedure or conduct of employees. It is foolish to imagine that the lowest possible prices have been obtained merely because the letting was public, bids being taken, and the award made to the lowest bidder; for many may not have bid who otherwise would have

been glad to put in a price, and others who did bid might have bid lower.

The disposition to be made of excess stores or equipment and obsolete or damaged material constitutes the one remaining point where the activities of the Bureau of Supplies are so closely related to those of other branches of the department that friction has often resulted. This work can best be done by a board of survey, consisting of an official of the bureau and a "staff" engineer. They should periodically inspect and survey all stores, equipment, engine spare parts or other supplies owned by the department for the purpose of (1) condemning and ordering to be sold all (a) obsolete material and (b) damaged material not fit to be repaired and (2) ascertaining whether such material as may be damaged or worn is worth repairing, and, if worth repairing, directing that said work be done.



Fair Play to Contractors Tendering for Public Works

Winnipeg, Jan. 7, 1914.

Editor Contract Record:

We have been greatly interested in your articles, "The Gratuitous Bid" and "Competitive Tendering," and by the ensuing discussion. While we are too busy at the time to enter into any controversy, we appreciate your efforts to mitigate contracting handicaps, and to translate our appreciation into practical form we have pleasure in sending you a few observations.

It is frequently the custom to give the contractor a set of plans and specifications without estimate, to be paid for at the lump sum price bid, with provision that if the quantities in any part of the work are more or less than are shown by the plans, additions or deductions shall be made at prices either fixed arbitrarily by the engineer or "to be mutually agreed on"—which means practically the same thing as the engineer's arbitrarily fixing the allowance. The contractor is not given the benefit of the engineer's estimate of quantities and if he happens to erroneously calculate the quantities from the plans, the loss is his. If he over-estimates the quantities on which his lump sum bid is based, he loses, because his bid is higher than his competitor's, even though he may have figured on a lower unit basis of cost and profit than his successful competitor. If he estimates too low, then the loss is his in a place that hurts, that is, furnishing without charge labor and materials on which he did not estimate. Could anything contribute more toward—or more forcibly invite—collusion between contractors, merely as a matter of "self-preservation?" When comparing notes as to quantities, what is more natural than that the contractors should try to agree on prices and endeavour between themselves to parcel out the contract before the bids are open?

The engineer who makes the plans is in the best position to estimate the quantities accurately. Why not give these most correct estimates of quantities to all bidders and take bids at unit prices—say, for instance, on paving work per cubic yard of excavation; per cubic yard of base; per square yard of pavement surface; per lineal foot of curb, etc.—and canvass the tenders and pay for the work on the basis of the unit prices and the actual quantities of work of each class actually performed?

In the New York State Highway Department work it is the custom to take bids on "grubbing and clearing" at a lump sum for the entire contract. Until recently any bid which ex-

ceeded the engineer's estimate by more than ten per cent. in any item was regarded as informal, and rejected. If on the item of "grubbing and clearing" for instance, the engineer did not know that any would be required, he followed, and still follows, the custom of estimating the nominal lump sum of one dollar and the contractor might tender as high as one dollar and ten cents, and have his bid considered. If the contractor in going over the work happened to see that the engineer's estimate was erroneous, whether by carelessness or design, and that the work would probably necessitate the removal of a lot of trees, stumps, road-side underbrush, or other of the variety of work classed as "grubbing and clearing," and he estimated that the cost would be, say \$1,000, he must either "absorb" the loss and "trust to his wits" to get it back out of the contract in some way, or he must "unbalance his bid" by distributing the amount among other items of his tender with the almost certainty that other less careful contractors will "take the engineer at his word" and assume that no "grubbing and clearing" will be required, and the careful conservative contractor would thus stand that \$1,000 chance of not being the low bidder. There are cases where on two miles of work the line stakes finally given by the engineer conflicted with large trees and other obstructions which had to be removed at a cost of over \$1,000, the contractor in tendering for the work having erroneously assumed that the "engineer knew his business" when he estimated, "grubbing and clearing, lump sum one dollar." In such a case is not the contractor almost justified if he tries to save that \$1,000 in cement or some other item by "stealing it from the contract?" Why is it more than common honesty, if the engineer does not see that any "grubbing and clearing" is to be done, to make no estimate and take no bid on that item, and, if unforeseen work is found, "pay for the work actually performed as an extra item at cost plus 15 per cent.," or at "prices to be agreed on?" If any "grubbing and clearing" is anticipated by the engineer, why not take bids therefore at unit prices, say, "per acre removing brushwood and debris;" "per tree or stump," with separate prices for trees or stumps having diameters of say 6-in., 12-in., 18-in. and 24-in?

It is believed that in some cases the engineer is so narrow as to purposely undertake to "put one over" the contractor through such means as we have outlined above, which are only samples of the many ways in which contractors are treated unjustly.

Adequate and Uniform Information

The sooner the engineer provides unit items and prices and accurately estimates quantities for every item, the sooner there will be removed one of the most potent factors in encouraging, yea forcing, dishonesty on the part of the contractor, and the sooner the cause for suspicion of contractors in general will be removed and the "owner" or "employer" will get honest workmanship at fair prices, which is the end to which the owner, as well as the contractor, should be working. The owner should be just as keen to see that the contractor's bid is not too low as to see that it is not too high, and if the contractor, through oversight or error, tender too low, not only should he not be penalized for refusing the contract, but it is to the interest of the owner that his bid should be rejected, for it is axiomatic that when the contractor is not getting a fair price for his work, the owner is not getting value or satisfaction.

With a contract which is fair and square to both the parties at prices allowing the contractor a reasonable profit, the basis of mutual fair dealing is established and unless one party or the other be more dishonest than most men mean to be, the result will be satisfactory to all concerned. The contractor will have completed a construction which is satisfactory to the owner and a monument to himself, and he will

have accomplished what every man is entitled to, namely, a fair return for a fair outlay.

Yours very truly,

"A Winnipeg Contracting Firm."

The Unaccepted Tender

Our London contemporary, *The Surveyor*, contributes the following, editorially, to the discussion inaugurated recently in these columns:

"Under the title 'The Gratuitous Bid' there appeared lately in the *Contract Record* an article in which the writer advocates the payment of contractors for the time and labour which they expend upon the preparation of their tenders. The argument is based upon the hypothesis that philanthropy has no place in commerce, and that payment or promise of payment is the basic condition in every business transaction. We are bound to say that the whole thesis appears to us to be founded upon a misapprehension. In the first place, the submission of a tender is a purely voluntary act on the part of each individual contractor, and in the second place the submission of a tender is merely an offer on the part of a contractor to do the work at the price quoted, such offers having been invited by the advertisement of the contract. Why should a public authority or private individual pay a contractor for his trouble in making an offer? If such payment is to be made, what safeguard is there to be against the making of offers which are not bona-fide meant to be accepted? These are some of the questions which must be answered before a case is made out for the suggested innovation. It is clear that in law none of the tenders or offers received need be accepted, even if the usual stipulation that 'the lowest or any tender will not necessarily be accepted' is absent. Further, a tender may be withdrawn at any time before acceptance. These are matters grounded upon the first principles of the law of contract, with which contractors ought to be thoroughly familiar. The preparation of offers to do work is, in our view, an ordinary business expense which every contractor knows he must incur, and which ought to be paid out of the margin of profit which he makes upon the works which he carries out."

A paper on the Manistee River viaduct, presented to the Western Society of Engineers by Mr. W. T. Curtis, describes some unusual work in pile driving and pier construction for the foundation of additional supports for the viaduct. Nearly 400 piles were driven to a penetration of 35 ft. in clusters of six and twelve on both sides of and close to the bents of the existing viaduct towers. All of the piles were driven through an old corduroy road which was discovered several feet below the surface of the ground and caused much difficulty and expense in removing or cutting through the logs. The pile driver had to be moved several times for each cluster of piles and was handled very advantageously from the deck of the bridge 75 ft. above the surface of the ground. The pile-driver tower, suspended from its center of gravity, was turned bottom side up and lowered between the tower bracing to the required position, where it was braced or guyed and a hammer operated between its leads to drive the piles as required. The engine was moved separately from the driver and the work was carried on without removing any of the old tower bracing. Sand and gravel for the concrete piers were dumped through the track above to stock piles formed on grillages of old ties set on the surface of the ice 75 feet below. The materials were distributed over the ice, mixed at the forms and deposited under water in very cold weather.



View of west approach and bridge.

Building the Substructure of the New C. P. R. Kildonan Bridge over the Red River

THE freight cut-off line of the Canadian Pacific Railway from Bergen, Man., to the large new terminal yards at North Transcona, crosses the Red River about two miles north of Winnipeg, a few hundred yards south of the old Kildonan Church and ferry. The new bridge is to have seven concrete piers and two abutments, with half-deck plate girder approaches to three truss spans on the river. From face to face of the abutment ballast walls the lengths will be approximately 930 ft.

The substructure work, which was done in the winter of 1912 and the spring and summer of 1913 by The Foundation Company, Limited, was of rather a difficult nature owing to the soft river bottom. Active work was started on December 17th, 1912, taking advantage of the ice, although a small force had been occupied for a number of weeks prior to this in building camp and fitting up the large plant necessary for the job. In addition to this a pile trestle was built over a ravine east of the bridge site to enable a spur to be laid down to the river bank for unloading materials and plant.

Night work was started on December 30th and the double shift maintained until April 7th, when the rising waters of the river and consequent breaking up of the ice necessitated a considerable reduction in the

force of men and caused work on the river to be temporarily delayed. During the high water period operations were continued, however, on both banks of the river, a day shift only being used. Night work was again resumed on July 7th in connection with the pneumatic caissons and final concrete work and was continued until the work was finished on August 30th.

It had been expected to have three river piers completed during the winter by working on the ice, but owing to its breaking up earlier than usual, only two were brought above summer water level. The third pier had been safely bottomed and the shaft started when high water necessitated stopping work temporarily on sand. By means of a heavy timber crib, carried to above summer water level, which had been built before the breaking up of the ice, operations were resumed by pumping down after the flood had subsided.

Pier Design

The original design of the bridge called for two abutments and six piers resting on wooden pile foundations and three mid-river piers with footings carried to rock. During the course of the work this design was changed considerably to suit conditions as they arose, so that the bridge as built is as follows: two abutments and four piers on piles, the pivot pier and



Piers, east abutment and west trestle.

west resting pier, sunk by the pneumatic caisson method, and east resting pier, resting on four concrete shafts extending to rock. Thus two piers were omitted entirely, the second pier out from the original planned west abutment becoming the west abutment.

A rather unique feature in bridge design occurred in connection with the west abutment. From past experience with the soft Red River Valley soil, it was decided to guard against possible sliding of the end of the fill approach. Accordingly, a wedge-shaped cellular anchor was built on the fill side of the abutment, consisting of 2-ft. concrete walls enclosing hollow pockets (these pockets to be train-filled later with gravel). These pocket walls rested on a concrete slab, two feet thick, covering the whole anchor site, and this, in turn, rested on piles.

As an additional safeguard against the slipping of the embankment, four rows of six piles each were driven west of this anchor and cut off five feet above the ground.

Heavy Plant.—This consisted of the following for the open work part of the contract: 5 double-drum hoisting engines; 1 three-drum hoisting engine; 6 stiff leg derricks; one 100 h.p. oil city boiler; two 80 h.p.

ice and a large amount of the material required at the piers was teamed out to the different sites.

No cement was used until it had been tested and passed by the C. P. R. chemist in Winnipeg, where the gravel and stone were carefully inspected by the resident C. P. R. engineering staff.

Concrete Mixing and Placing.—The standard concrete mixture for this job consisted of one part cement, three parts sand and five parts stone.

The east abutment and three piers served directly from the east bank were concreted in two stages—before and after the spring flood. The “pre-flood” plant consisted of a $\frac{3}{4}$ -yd. Smith mixer and 1-yd. Marsh-Capron mixer. In this manner the east abutment was carried up to the ground level; piers 9 and 8 to a safe distance above summer water level. During this winter season the concrete went directly from the mixer to the east abutment and pier 9 in derrick-handled buckets, but for piers 8 and 7 the concrete buckets were hauled over the ice on sleighs and the concrete was deposited by derricks commanding the piers. The second stage of the concreting at this east end of the bridge was handled by means of a pile trestle out as far as pier 7, concrete being deposited partially by derrick and



General view of substructure work for Kildonan bridge, looking west from east bank.

Kewanee boilers; 2 drop hammers; 1 Vulcan steam pile hammer; 1 New Monarch steam pile hammer; one 1-yd. Marsh-Capron mixer; one 1-yd. Ransome mixer; two 8-in. centrifugal pumps; one No. 4, two No. 3 and two No. 2 Nye steam pumps, besides smaller pumps and buckets. Assistance was had from a $\frac{3}{4}$ -yd. Smith mixer and a $\frac{3}{4}$ -yd. Chicago mixer hired for a short time during the spring.

For the compressed air portion of the work in July and August the following plant units were used in conjunction with the above list: one 90 h.p. Ames boiler; one 24-in. x 24-in. x 30-in. Ingersoll-Sargeant Air Compressors; two 12-in. x 12-in. x 18-in. Canadian-Rand Class “C” Air Compressors; 2 air locks; 1 hospital lock, buckets, etc.

The principal item of interest in connection with this plant, aside from the quantity, is the bad quality of Red River water for boiler purposes.

Concrete Materials, Storage, Etc.—These were as follows: Canada brand cement, gravel from the Bird’s Hill and Marquette Main Line pits, and crushed stone from the Manitoba Quarries, Limited. These were brought in and unloaded during the winter on the east side and during the summer on the west bank. A roadway was constructed down the east bank on to the

partially by concrete buggies. Material was fed to the mixer from the storage pile by 1-yd. side dump cars hauled by horses.

On the west side the only pier started before the spring flood was pier 3. This was concreted up above the summer water level by the same $\frac{3}{4}$ -yd. Smith mixer formerly used on the east bank. The west abutment and pier 3 were finished in the spring (soon after the flood had subsided) by the same derrick. For the top stages of pier 3, however, an elevated distributing tower was used.

The gravel and sand for the west bank mixing plant in this first stage of the concreting were hauled from the storage yard to the mixer in tilting dump cars, by means of long cables attached to an engine placed close to the mixer. The second and final stage of the concreting, embracing piers 4, 5 and 6, was vigorously prosecuted to a successful conclusion during the months of July and August. The battery of mixers for turning out this concrete was composed of the 1-yd. Ransome mixer and 1-yd. Marsh-Capron mixer, which were set up at the end of a long trestle leading out to the centre of the river. The concrete was hauled to within reach of the derricks at the different piers in buckets on flat cars along a narrow gauge railway.

These cars were fastened to a continuous cableway which was controlled by a standard hoisting engine placed close to the mixer. The concrete materials were delivered to the mixers in side-tilting dump cars from the adjacent storage yard. By this arrangement 200 yards of concreting was considered a fair 10 hours run.

Concrete Reinforcement.—For reinforcing purposes in all piers 50-lb. rails were used. Rails were also placed at the nose and shoulders of all river piers. These were locked securely into the concrete.

Sheeting—Wooden and Steel.—On the east and west abutments and pier 3, three-inch tongued and grooved sheeting was used, while at pier 9 this was increased to 4-in. At pier 8, where the water was deeper, 9-in. Wakefield, composed of three 3 x 12-in. boards, was found to give good results. The lengths of the latter sheeting varied from 30 to 36 ft.

At piers 7 and 4, forty-foot steel sheeting was driven. No trouble was experienced in doing this as no large boulders or other difficult material was encountered. To insure tightness at the time of pumping out, an outer row of steel sheeting was driven and the intervening space filled with clay. All of the above sheeting, both wooden and steel, was driven with steam hammers hung in suspended leads.

Open Excavation.—All piers and abutments—excepting piers 5 and 6, where the pneumatic caisson method was employed—were excavated in the open after pumping out the cofferdams. The material was removed in 1-yd. buckets by stiff leg derricks, two of these usually being set up at each pier.

During the winter season the heavy frost, which penetrated about six feet into the ground, naturally caused much inconvenience, but the continuous work of the day and night shifts helped matters considerably. At the sites of the river piers, the ice, about three feet thick, was removed from inside the cofferdam by steam under tarpaulins.

Pumps and Pumping.—Eight-inch centrifugal pumps were used for heavy duty, such as pumping a cofferdam from the river level down to river bottom, while suspended pumps, such as the Nye and Pulso-meter, were used to handle any water leaking from the cofferdam. The principal difficulty experienced in this connection was during the winter season, when the severe cold weather caused considerable trouble, notwithstanding that the steam lines were heavily covered.

Pneumatic Caissons.—The two pneumatic caissons for the mid-river piers were built on the west bank and successfully launched and towed to place. The pivot pier caisson was approximately 65 x 35 ft. and the west rest pier 70 x 20 ft. British Columbia fir was used exclusively. The former caisson when launched weighed 110 tons and the latter 83 tons. On account of the large amount of timber in these caissons (178,000 ft. in the former and 142,000 ft. in the latter) considerable economy was effected in using pneumatic boring tools in drilling driftbolt holes, etc.

Caisson Sinking.—This part of the work was carried on very rapidly and smoothly, resulting in both piers being carried down to a satisfactory bottom in hard pan. The material encountered consisted of soft blue clay and black sand. As two air locks were used on each caisson and each was served by its own derrick, considerable excavation was made on each of the three eight-hour shifts. Where possible, and the nature of the soil would permit, blowpipes were used. The topping out of the shafts themselves at piers 5 and 6

completed the concrete work. This was finished on August 30, one day ahead of scheduled time.

The Foundation Company, Limited, of Montreal and Vancouver, were the contractors for the substructure, the work being carried on under the supervision of Mr. J. G. Sullivan, Chief Engineer of the C. P. R., and Mr. Frank Lee, Principal Assistant Engineer. Mr. W. F. Oldham was Resident Engineer.

Red Water in Municipal Supplies

The cause of "Red Water," suspended iron oxide in municipal supplies, has been studied by Mr. A. T. Stuart at the chemical laboratory of the Department of Agriculture Experimental Farm, Ottawa, Ont. Coils of iron wire and of iron-copper, iron-aluminum, and lead-aluminum combinations were suspended in bottles containing 400 c.c. of various waters to be examined. The tests were not carried beyond seven days, as it was felt that actual conditions in any city supply were then exaggerated. Raw and mechanically filtered waters from Watertown, N.Y., were used, together with raw, mechanically filtered, chlorinated, and magnesium-oxide precipitant samples from Ottawa. It was found that no appreciable difference existed in the action of raw or treated waters, so far as they could be revealed by losses in weight of the metals. There were, however, extreme and important differences in the character of the water. It was found that the raw waters, although corroding iron to the same extent as the others, did not coat the iron with as much flocculent material, nor did they allow the iron held to settle out, as is the case with treated waters, but retained a large proportion in solution or colloidal suspension. The treated waters, at ordinary temperatures, became very murky and opaque, and when hot, large amounts of brownish-red rust appeared ("red water"). From these it would appear that the state assumed by the iron taken from the immersed metal is a much more important question than the actual amount, and the inference is that the so-called mechanical filtration of these waters is liable to bring about this trouble. The waters examined were of low mineral content and highly colored by peaty substances.

Aqueduct signboards of the form of vitreous tiles are being placed on the inside surface of New York's Catskill aqueduct at every fifth station as a location guide for those making a boat or walking inspection within the conduit after its completion. Since the aqueduct is about 100 miles long, it would be difficult to determine one's location within the dark bore without these marking plates. The tiles will be placed on the left side of the aqueduct with respect to the direction of increasing stations, the longitudinal axis of each being about 3½ ft. above the invert of circular tunnels and 12 ft. above the invert of grade tunnels and cut-and-cover aqueduct. Each tile is 4 x 9 x ½ in., with two ⅜-in. holes for bolting to the aqueduct by bronze expansion bolts. Seventeen hundred tiles were inspected, 18 per cent. being rejected on account of cracks and insufficient glazing. Of those accepted, 21.5 per cent. were returned to the kiln for additional burning to meet the specified requirements in density. Three and one-half per cent. of the total were subjected to the red-ink test, which consists in immersing for one hour. At the end of this period the penetration should not exceed ⅛ in. in order to fulfil the requirements.

The Decorative Possibilities of Concrete

(Concluded from last issue)

NOTWITHSTANDING the excellent decorative work which has been done in plain and reinforced concrete, there are, nevertheless, numerous advocates of tile decoration. Instances are many where the use of brick or tile emphasizes the contour and enlivens the surface at very little expense. A little touch of color relieves the monotony of a single toned exterior and is illustrated in the seed warehouse of Otto Schwill & Company, at Memphis, Tenn. This building would undoubtedly be equally as efficient were it built without any attention to pleasing architectural effects. With the present leaning toward pleasant work rooms for employees, this idea has spread to the exterior with the result that our factories are surrounded by grass plots and gardens and the buildings themselves as far as possible are made to conform with the tendency toward providing pleasant environment.

The office building of the Packard Automobile Company at Buffalo, New York (Fig. 30), is an equally good example of the combination of concrete and brick, although the decoration is of cast concrete. Carrying this idea further, the Ford Automobile Company at Detroit, has not only built of reinforced concrete with brick inlay and corner towers but has called in mosaic tile to brighten up the panels under the cornice, and though the embellishment was achieved at some expense, the architect felt that the attention to this detail was deserved.

Another example of the use of colored clay tile for concrete decoration is to be found in Minneapolis, where on the north shore of Lake Calhoun a large building has been constructed of reinforced concrete, called the Calhoun Baths (Fig. 31). The central portion of the building is roofed and serves as the entrance, housing the ticket office, the rooms where bathing suits, towels, and keys to lockers are distributed, and the refectory. It also connects directly with the terrace above the bathing beach. The dressing rooms on

the opposite side of the central portion of the building are without roof but are fitted with concrete rooms and steel lockers in double tiers. In order to reach the beach, the bathers must pass through a pool of water and through a triple shower direct from above and from both sides, so that a partial wetting is received before reaching the beach.

The concrete was deposited rather dry in order to obtain a rough finish, and the form marks do not seem to detract in any way from the pleasing surface made by the coarse aggregate. The decorations are of brick



Fig. 31—General view of Calhoun Baths, Minn.

and clay tile, the brick having been placed when the concrete was poured, but the tile subsequently, space being made of them by tacking wooden shapes to the inside of the form. The design and construction for this building were handled by Chapman & Magney of Minneapolis.

It is not surprising that an individual directly connected with the cement industry as is Albert Moyer, should build of concrete, nor is it surprising that one who is so well versed in concrete construction should obtain very pleasing effects as indicated by the work on his residence at South Orange, New Jersey (Fig. 32). Liberal use has been made of exposed aggregates, employing a mixture of Portland cement with limestone screenings, marble chips, and dark trap rock. Not stopping here, much dependence has been placed upon Moravian pottery decoration, which harmonizes well with the concrete surface, as is shown in the fireplace, with its inlaid panel showing an Indian at a fire, whether warming his hands or starting the blaze being not self-evident (Fig. 33). The balcony, also, has been worked out in pottery but somewhat differently than the fireplace. The distinguishing feature lies in the fact that instead of being inlaid, the figure comes out in base-relief and although somewhat serpentine in design, seems fairly consistent with the grape-vine motive. Undoubtedly this panel would be somewhat softened to its improvement by the ivy which was evidently not in leaf when the picture was



Fig. 30—Office building, Packard Automobile Company, Buffalo, N. Y.

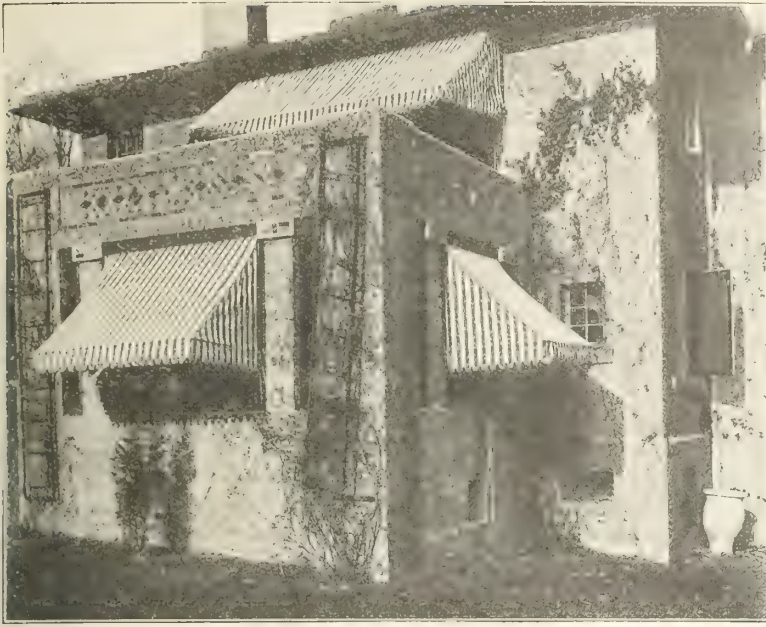


Fig. 32—Porch detail, residence of Albert Moyer, South Orange, N. J.

taken. For some time, Alfred Hopkins, of New York, has been a strong advocate of reinforced concrete for the construction of buildings and has added a large amount of information to our knowledge of the concrete of the old Romans, having investigated this point personally and in some detail. Nevertheless, Mr. Hopkins has never brought himself to believe that concrete should be used for the ornamentation upon buildings of the same material. For this purpose he advocates terra cotta, and judging from the excellent work which he has achieved on the residence of Charles E. Rushmore, there is reason in his contention. This building is all of reinforced concrete to the roof and part of this has been constructed of concrete slabs. But for the panels and column capitals, Mr. Hopkins has turned to terra cotta tile, with excellent results. For the average individual, of course, a detail of this kind would be prohibitive in cost. But with such a sized undertaking as this mammoth residence, the high individual cost of these panels (Fig. 34) is small when compared with the total cost of the building. However, with the advances which are being made in the use of colored aggregates, it is generally possible to obtain all the color variations necessary in the concrete itself.

It is not customary to build reinforced concrete roofs of the pitch type. In fact, there is no sensible reason for adhering to this construction when designing reinforced concrete (Fig. 35). The ideal concrete house is built with a flat roof not only because architecturally the design may be made pleasing, but because this type is the most economical in cost of space. An attic of little use except for the storage of material which, in the majority of instances, will never be needed again, and when stored away in an attic corner, invites spontaneous combustion. Reinforced concrete has brought with it a new architecture and the sooner we appreciate its value, the earlier will be the general adoption of reinforced concrete for residences as well as the endless other types of construction to which it has already been applied.

Within the last few years, there has been a decided leaning toward the community settlement idea, and

with this in view, the Forest Hills Gardens were designed (Fig. 36), not, as many people have inferred, an endowed neighborhood where buildings have been erected to house working people, but a business investment of the Russell Sage Foundation Company. It is in no sense managed as a charity, for whoever deals with it is expected to pay fair value for everything received. It is, however, an attempt to solve the housing problem for persons of modest means and its development will consequently be watched with interest. Perhaps this is the first example in America, where an absolutely barren site has been taken and treated along the lines of modern methods of town planning. Throughout the village, advantage has been taken of practically every structural material for building the dwellings, but a large part of the improvements has been worked out in concrete, including the railroad station, the city market, and many of the individual dwellings as well as garden walls, foundations and the like.

Oswald Hering has utilized lattice work on one of his most important dwellings in combination with decoration of molded concrete.

But where Mr. Hopkins would use terra cotta, as in the panel inserts, Mr. Hering has used concrete, depending upon exposed aggregate to furnish the touch of color needed. Within, the lattice idea has been continued, but in an entirely novel manner by simply stenciling the lines upon the wall, instead of using wood as in the exterior panels (Fig. 37). Such lattice work would not find great favor with the particular housewife because of the tedious work of dusting.

Wood paneling will also break up large areas of concrete surface and is entirely in keeping with the old half-timbered style of architecture, so familiar to



Fig. 33—Fireplace in the home of Albert Moyer, South Orange, N. J.

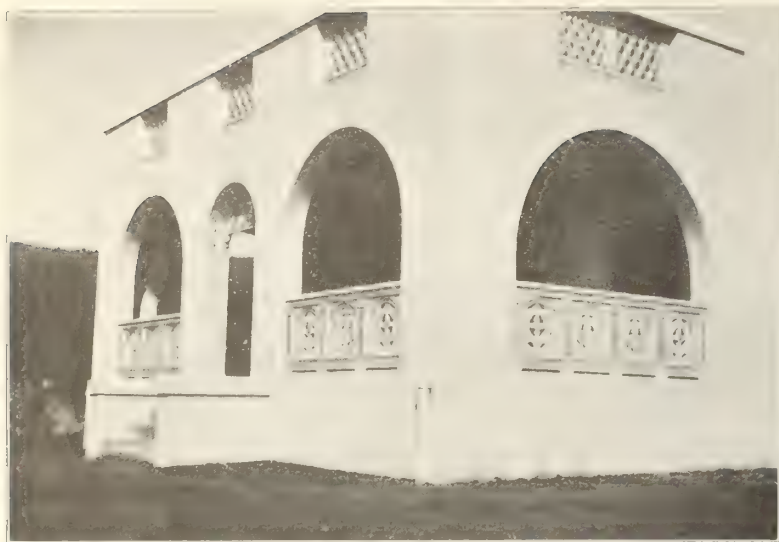


Fig. 34—Porch Detail, residence of Chas. E. Rushmore, Woodbury Falls, N. J.

our forefathers. It is impossible to appreciate the pleasing surface which has been obtained on this modest appearing dwelling (Fig. 38), but a slight explanation may help to make clear how the effect is obtained. The finish is known as a dry dash and in this instance has been applied to concrete blocks. After the plaster coat has been placed, a dash mixture of white marble and blue stone chips with gravel screenings is thrown on, which imbed in the mortar and furnish a clean, bright surface without further treatment. When a coarser effect is desired it can be obtained by a rough cast, the mortar mixture being thrown on with a paddle and the texture of the surface depending entirely upon the size and character of the aggregate and the consistency of the mixture.

Stucco finish has found favor when applied to concrete blocks as a backing, and there are some architects who believe that this is the only satisfactory means of handling what has seemed to be in many cases a sad makeshift so far as a building material having architectural merit is concerned. This impression has probably grown from the continued manufacture of rock-faced and inferior blocks by those who are entirely unqualified to undertake this kind of work. Such examples as the Normal Park Methodist Church in Chicago (Fig. 39), the blocks for which were built by the American Hydraulic Stone Company, and the design



Fig. 35—Cement stucco residence of L. G. Stumer, Chicago.

executed by H. B. Wheelock, has done much to eliminate this impression. The tone contrast was here obtained entirely by the use of colored aggregates, using the natural sand finish on the trim but a dark granite for the body. The surfaces were then scrubbed to expose the aggregate and the building is itself a strong recommendation for the much maligned concrete block.

The residence of E. S. Harkness, at New London, Conn. (Fig. 40), is also of the same kind of blocks and depends for its merit not only upon a design appreciative of the value of the material but also upon the care in laying up the walls. Concrete blocks are not confined to exterior use, by any means, however, as is illustrated by the work of Emerson & Norris, on the interior of the Second National Bank Building in Boston. A combination of a tooled surface with careful laying and a little introduction of cast stone work has made the interior of this structure not only dignified, but thoroughly cool and reposeful.

Oswald Hering says that the so-called dry process concrete block is not of concrete at all. Having had little acquaintance with water during its process of manufacture, it consequently harbors an un-



Fig. 36—Forest Hills Gardens, New York.

quenchable thirst and when used in the outside walls of a building, proceeds to make up for lost time, every rain-storm furnishing the elements of a "spree" to the detriment of the block and the appearance of the dwelling. The dry process, however, is not necessary, it being equally as easy to add enough water to insure excellent concrete. The possibility of careful inspection during its manufacture is a strong point in favor of the continued use of this really excellent building material.

After considering the all-concrete buildings and the buildings in which other material has been used for ornamentation, it is interesting to turn to work where the latter condition has been reversed and is well illustrated by the work of S. T. Yourtee on the Kingsbury Apartments in St. Louis (Fig. 41). The blocks were cast in sand molds, and on account of the surface given by this method, subsequent treatment was unnecessary because of the peculiar matte surface which the rough sand mold provides (Fig. 42). Very intricate figures are easily worked out by



Fig. 37—Interior of Gage E. Tarbell's residence, Garden City, L. I., showing substitution of fresco for lattice.

this process and many buildings in St. Louis attest to Mr. Yourtee's skill in handling concrete.

Another prominent figure in the manufacture of decorative concrete stone is the Economy Concrete Company of New Haven, Conn., which has begun at home to demonstrate the possibilities of concrete for furnishing the ornamentation for buildings of other material. Some of the most interesting work which this company has done, and that which it prizes most highly because of the personal interest, can be seen by all those who visit the home office, where the fireplace is composed principally of ornamental concrete stone (Fig. 43). The figures above the mantel are molded after the various workmen about the plant, with the exception of the one at the far right, who represents transportation. The other figures represent in their order (1) the draftsman laying out the plan, (2) the sculptor working over the pattern, (3) the laborer pouring the concrete, and (4) the workman putting the finishing touches on the surface and correcting any flaws caused by removing the forms.



Fig. 39—Concrete blocks in the construction of the Normal Park Methodist church, Chicago.

The work is all cast in solid and uniformly proportioned concrete without special surfacing, using wooden or plaster molds. Where necessary, glue molds are employed for the under-cut work. This, of course, gives a rather smooth surface and is the only criticism which could be made of the product. With but slight additional expense, however, the surface can be chiseled so as to relieve what sometimes appears to be a rather putty-like surface when fresh from the molds.



Fig. 38—Residence, Jamaica Estate, L. I.

The work of this company has favorably impressed such architects as Cram, Goodhue & Ferguson, who designed a number of buildings at West Point, including the gymnasium and cadet barracks (Fig. 44). In these structures all the stone work above the first storey has been cast by the Economy Concrete Stone Company. The close scrutiny which the government gives the building materials it uses is well recognized and the use of concrete stone in so important structures is a strong recommendation for the material. On the interior, all the stone decoration is of concrete, including appropriate relief panels of athletes at various sports (Fig. 45).

The chapel of St. Paul's Church at New Haven, Conn., has furnished another opportunity for this company to demonstrate the superiority of its product, as concrete stone has been used for decorating the old granite structure over 75 years old (Fig. 46). Just lately, the opportunity presented itself to brighten up the old building with concrete, and how satisfactory has been the result is self-evident.

It should make no difference whether the stone trimming is artificial or natural, the end achieved is that upon which we should pass

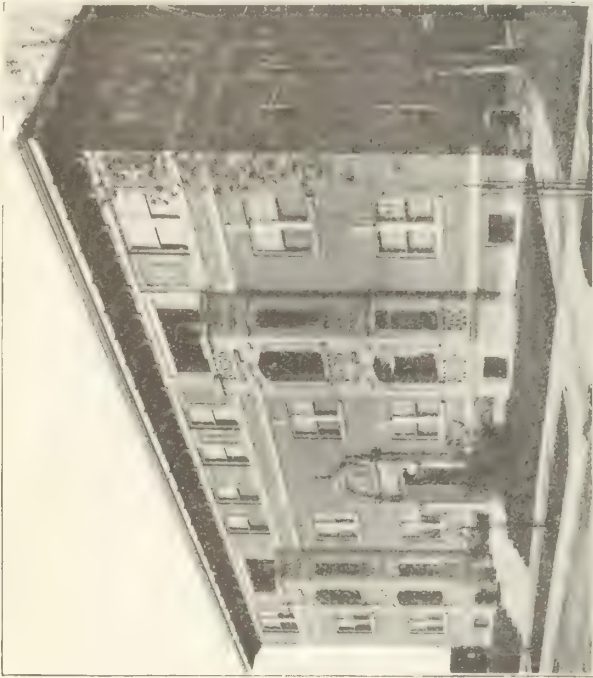


Fig. 41. Kingsbury Apartments, St. Louis, Mo.



Fig. 43 Fireplace detail, Economy Concrete Company, New Haven, Conn.



Fig. 40 Residence of E. S. Harkness, New London, Conn., built of concrete blocks.

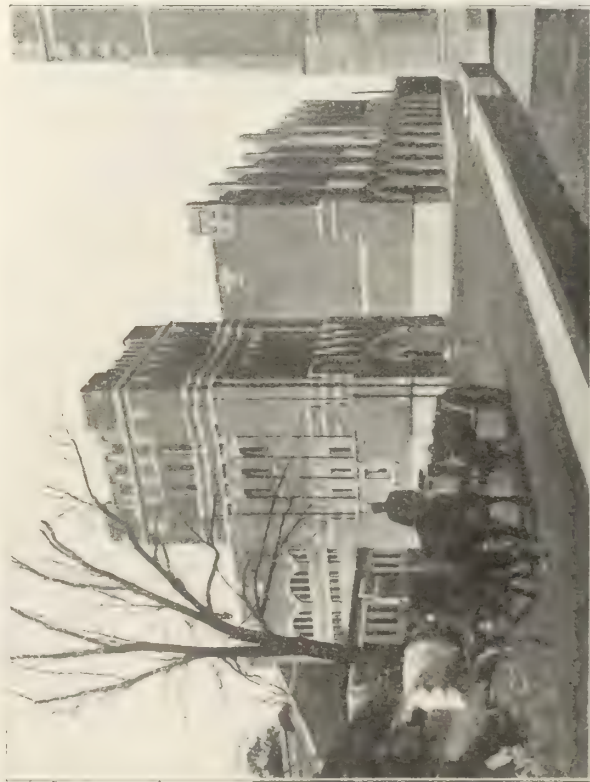


Fig. 44—Gymnasium, U. S. Military Academy, West Point. All trim above the first storey of concrete stone.

judgment. In reality, it matters not whether the aggregate in the concrete has been bonded by nature, or by the hand of man with Portland cement as the binding material. So far as permanence is concerned, concrete has already proved beyond a doubt its superiority to many of the natural stones.

St. John's Church is built of a local trap rock which is of a natural gray surface (Fig. 47). But mingled in through the walls are many stones which are rusted, giving a weathered effect, which unobtrusively accentuates the concrete ornamentation, carried even through the tracery of the windows and the tower, and is much in evidence on the interior.

Another instance of concrete applied to ecclesiastical architecture is found in the Broadway Presbyterian Church of New York City (Fig. 48). The natural stone walls of the building are of New York gneiss laid up in random ashlar, and all the trimming, including the window tracery, is of concrete stone. This was cast in sand molds by the Onondago Litho-lite Company, of Syracuse. The aggregate used for manufacturing this particular stone is made from Gouverneur marble, a hard calcite product from northern New York. This flinty material in crushing, breaks into sharp angular pieces, which are graded into several sizes, depending upon what work they are to enter. After removal from the sand molds, the concrete is carefully cured and then tooled and surfaced by machinery. The surface obtained is identical with natural stone—but oftentimes is superior to it, because of its greater ability to resist the action of the elements. Conclusive evidence of this characteristic is to be found in the old sandstone decoration on the Königsbau at Stuttgart, erected about 30 to 50 years ago. The upper cornice was ornamented by a number of large figures which began to disintegrate, making replacement of some of the parts necessary from time to time. As a final remedy, the officials proposed duplicating the figures in concrete. This decision was arrived at after inspecting several artificial stone figures which had shown practically no deterioration after 20 years of exposure to the elements. The surface of the new figures was tooled after coming from the forms so that they were identical in texture with the discarded sandstone models.

The Universal Portland Cement Company attempted something unusual in the construction of its new office building at Buffington, Ind. (Fig. 49). The building is of plain faced concrete blocks with the monotony broken up by the insertion of smaller squares and bands. The surface is further brightened by a ground surface finish which exposes the limestone aggregate and adds life.

In Boston, an imposing memorial showing tooled surface has been erected in Post Office Square (Fig. 50). This pleasing combination of cast stone with monolithic concrete was erected by Emerson & Norris and designed by Messrs. Peabody & Stearns, all of Boston. The monument is supported on reinforced concrete piles and the central portion is faced with cast stone, but the shaft was cast in place and afterward bush hammered to match the ornamentation. For aggregate, a mixture of granite, white and black marble, was used, which when exposed gives a sparkling and contrasty surface, displaying the combined characteristics of the individual materials.

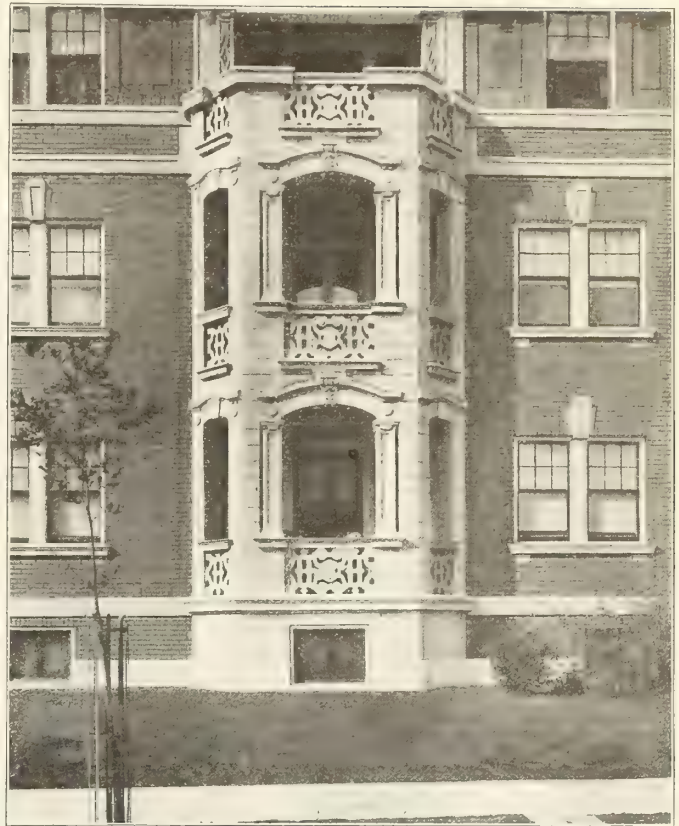


Fig. 42—Detail of concrete trim on Kingsbury Apartment Building, St. Louis, Mo.

The writers, not being architects, have dealt somewhat sparingly with the subject of architectural and decorative possibilities of concrete and have rather depended upon the illustrations to indicate the purpose of this paper. After all, architecture and architectural decoration is a peculiar study. On the one hand, we have those who contend for close adherence to the ancient styles of architecture, and on the other hand, we have many brilliant minds who have achieved wonderful results and designed some of our most pretentious structures along entirely new lines, yet without voluminous criticism from those who consider themselves authorities. However, since this paper has dealt more particularly with the architectural side of



Fig. 45—Interior of Gymnasium, U. S. Military Academy, West Point.

concrete, it is, perhaps, fitting that we close with a quotation from Oswald Hering, who has made a study of concrete and its architectural and decorative possibilities, and who, by the way, is a son of Rudolph Hering, an honored member of the Western Society of Engineers:

"Concrete can be easily and rapidly manipulated. It is less expensive than either clothed steel or masonry construction alone; it does not deteriorate with time and it is practically fire and waterproof. It grows in strength for a considerable length of time and after having attained its ultimate strength, it never weakens, consequently, by its use, lighter, cheaper and more durable structures may be erected than with any other known materials."

Regarding concrete stone he says:

"The time would seem to be not far distant when concrete will very largely supplant marble and stone where castings are practical. These should not be termed 'imitations' of stone, for the ingredients are largely the same as are found in real stone. Nature's process of employing time and gravity has simply been superseded and accelerated by man's mechanical ingenuity."

DISCUSSION

Mr. Boynton.—We found many points of interest in preparing this paper. The work of the Economy Concrete Stone Company is of particular interest because they have developed a type that they insist on making one way; if the architect likes it he can use it, if not, he can leave it alone. I think that is one reason why they have succeeded so well in getting a product that is uniform and really desired by the architect because it is dependable.

The Economy Concrete Stone Company cast their product in the different molds necessary to get the lines desired and then rub the product with rubbing stone, carborundum, or whatever is necessary to expose the aggregate product. When I last visited their plant they had a large piece that they were casting for a Government hotel at Panama. The Government holds this company in high esteem, because of the quality of the stone they are producing.

The work that the Emerson & Norris Company are doing is wonderful in that they have practically displaced building stone for entrance decoration in Boston. There are block after block of apartments in which all the entrance work and all the stone trim from the ground up to the window-sill, on the first floor, is cast stone or concrete stone rather than natural stone. Natural stone is no longer "in the running" where other stone can be obtained, because the latter is more uniform; it is more economical, because it can be cast in practically the shape and form required and thus reduce the cost of cutting to a minimum. This does not mean that it is sold cheaper because it is less attractive or less desirable (it is really more attractive and more desirable), but being influenced by the cost of the product it results in economy.

The Germans have been replacing with concrete, for twenty years or more, all the old stone work that has deteriorated. The stone work referred to as being now replaced with concrete was mentioned last December at the annual meeting of the National Association of Cement Users. A gentleman from Germany was in this country at the time, who had some lantern slides showing work in which they were replacing figures on the top of some of the German Government buildings. Some of the pictures showed where they were replacing with concrete the old sections of heavy stone columns which had deteriorated, retaining the form and

texture and color. He said it was not at all uncommon to do that.

Question.—Where cutting of the cast stone is necessary, can as delicate work be done as on the natural stone, or is there a tendency of the material to spall or crumble under the chisel?

Mr. Boynton.—I believe good concrete will not spall as readily as natural hard stone. You doubtless have noticed some effects of concrete blocks (for instance, such as Mr. Hering referred to) where sufficient water had not been used in mixing the concrete, and where the blocks had been improperly cured, etc. That results in a crumbly product and chiseling is impracticable. In fact, the ends could be rubbed off with the finger. But a well-made concrete product can be worked in a manner similar to that of good building stone. The way it will cut will depend somewhat on the age and the size of the aggregate. If made of large aggregate it would require more time, so as to resist the tendency to break through the aggregate at a point not



Fig. 46—Chapel of St. Paul's Church, New Haven, Conn. Window tracery of concrete stone.

broken by the chisel, but after it is properly aged the size of aggregate makes no difference. If a product were to be chiseled it would naturally be made of finer aggregate; that is, $\frac{1}{4}$ to $\frac{1}{2}$ in. rather than $1\frac{1}{2}$ in. stone. There is no danger of properly-made concrete spalling or crumbling after it has reasonable or proper aging.

President Reichmann.—About how old must concrete be before it can be worked with a chisel?

Mr. Boynton.—If necessary, and the concrete were cured under steam, it could be chiseled in a week's time, if made with that in view; but under ordinary circumstances with normal aging under normal temperature and with water only, I think it could be chiseled safely in thirty days.

Question.—I would like some information as to how the ornamental tiles are applied. Are they placed in the forms before the concrete is poured, or, if not, are blanks for them provided, and the tiles subsequently inlaid? Also, is any material or backing or mechanical bond for them necessary?

Mr. Boynton.—It is usually the practice to put a blank in the form, outlining in a general way the shape of the figure or the tile that is to be set in, having the blank the same depth as the piece to be set plus a light mortar backing. Then with careful setting, thorough moistening of the con-



Fig. 47—St. John's church, Hartford, Conn. All trim and tracery of concrete stone.

crete, and careful placing of the tile in the proper mortar, it adheres firmly.

Question.—What material was used in stenciling the interior of the building that represented the lattice? Was it paint?

Mr. Boynton.—I presume it was. There are a number of formulae that will produce good paint for painting on concrete, even on green concrete. Any form of linseed oil paint can be used, if the concrete is thoroughly aged. But we never know exactly when it reaches that point and we are apt to want to decorate the surface before that time. With the use of the proper formula it is perfectly safe to paint concrete as soon as it ordinarily dries out, say in thirty days' time.

Question.—Must the paint be something special?

Mr. Boynton.—Yes, but it is an inexpensive paint. Linseed oil on concrete may prove troublesome and have to be removed.

Mr. Stineman.—The statement is made in the paper that pleasing architectural effects may be made in concrete with very little or no additional cost. That is something which engineers should bear in mind, because many of them are inclined to the belief that anything which looks well will cost too much. As a result they erect buildings which are nothing but walls with holes in them, and bridges and structures that are unsightly from an architectural standpoint. They say, "We will put up the structure so it will hold and do the work, and never mind how it looks." Yet with the same or a little more money a pleasing architectural effect might be had. I notice among the illustrations several viaducts in this city, plain in surface or plain in line, which have a pleasing effect because some architect or some man who understood archi-

tecture designed them. I would not go so far as to say that engineers should be architects or should make a study of architecture, but I believe engineers should either learn something about architecture or else, in the case of structures which are built in places where people must look at them for years and years, engage an architect to design for them, if they are not able to do it themselves.

President Reichmann.—I think that is a very good point. It is only within the last few years that engineers have ceased using most of their time developing new theories for the engineering profession. We are now spending a little more time developing architectural effects of our designs. Years ago, an attempt in the line of aesthetic design in connection with factories was immediately cut short; the owner would not allow the engineer to put anything on the structure in the way of ornamentation, because it would cost a few dollars. But we are now approaching the time when there is more willingness to give the structure attention from an aesthetic standpoint. I believe the engineer is cap-



Fig. 48—Broadway Presbyterian Church, New York City.

able of doing this, but heretofore he has not been permitted to do it. There is a great difference in the factory of today and the one built twenty years ago. At the present time, the light and the general features are thoroughly considered before the work of planning is started.

Mr. Boynton.—Regarding the work of Mr. Squires in New York, there is one point I might mention as to getting the decorated ceiling effect by using inverted sand molds for the forms. We tried to secure a photograph of the finished ceiling, but had to give up the idea after making several efforts, because of the difficulty in getting back far enough and securing the proper lighting.

In that work Mr. Squires has gone a step forward, I think, in that he will get all the strength he requires through the beams between the decorations.



Fig. 49—Office buildings, Universal Portland Cement Company, Buffington, Ind.

He will also do away with the plain ceiling at a cost that will be taken care of by the cost of a plain ceiling. He says the cost of building such a ceiling is practically nothing, over the plain ceiling. He saves weight with his structure—saves all the way down the line—and he has a decoration when he gets through that is attractive. Those things are well worth our consideration, and doubtless many of us in every-day work will see how by study we can get some decoration or pleasing effect without adding materially to the cost; possibly decreasing the cost. Mr. Squires is an architect and not an engineer; that is, he is practising as an architect, and his work has been confined very largely to residences and apartments. But the same principle can be used in other buildings where a decorated ceiling is desired or there is any desire or need for breaking up the monotony of a ceiling. The cost of

concrete there are great possibilities for beauty, and this beauty can be brought out by giving a little thought and study to the matter.

The Movement of Tall Buildings

THE recent statement of the Superintendent of Buildings of Chicago that virtually all of the immense buildings and skyscrapers of the downtown district are out of plumb, calls attention to a peculiarity of tall buildings little realized and still less understood outside of the architectural and engineering professions, says Building Progress. The common impression is that all heavy and massive structures are rigid, firm, and immovable; yet, in Chicago, according to the Department of Buildings they have not one but scores of buildings like the leaning tower of Pisa, only they do not lean so much, thirty inches being the most that any of them are out of plumb.

So far from being perfectly firm and rigid, all tall buildings are subject to two distinct movements, and all heavy buildings erected on anything but bed rock have three distinct movements to their credit.

The city of Chicago, built as it is on sub-strata of clay, furnishes the most interesting study of the movement of buildings, and the greatest number and variety of examples. All of the early skyscrapers of that city were carried on floating foundations or on piles driven deep into the clay. These buildings without exception settled into the soil due to their weight, the distances they settled varying from three to over five inches. Many of these buildings, notably the Great Northern Hotel, are partially carried on jacks and periodically levelled up as settlements occur, then, after all subsidence has taken place, and the buildings have finally come to rest, the jacks are removed and the foundation walls filled in with masonry.

That is one of the movements of buildings, then, settlement; but settlement takes place only in those buildings erected on floating foundations. When the footings are extended down to bed rock, as all footings for present day buildings in Chicago are, the amount of settlement that takes place is nil and may be disregarded.

But even buildings with their footings carried to bed rock lean or are racked out of plumb, and the taller the buildings the more they are likely to lean, although the amount they are out of plumb is seldom enough to endanger the structure. Recently the Building Commissioners of Chicago ordered the Unity Building straightened as it was "unsafe but not dangerous," being thirty inches out of plumb. In an interview they said: "It is impossible to prevent the big buildings here from leaning. Some of them are not straight when they are finished, but that does not impair their safety. It is probably safe to say that every building in the city leans more or less. If they are on floating foundations they also settle gradually." But there is still another movement of buildings, and the most interesting of them all to consider. According to an exchange, "The Eiffel Tower swings perceptibly in the wind, and even stone shafts like those of the Bunker Hill and Washington monuments move several inches at the top. In these cases the cause of the action is not only the wind, but the heat of the sun. The side that is towards the sun expands during the day more than the side in shadow. An interesting device has been employed to show the movement of the dome of the Capitol at Washington. A



Fig. 50—Angell Memorial, Post Office Square, Boston.

such work will doubtless be a little more until we become accustomed to it, or until we have men trained to making the blanks.

One thing that has kept us back and interfered with the proper development of concrete, is that the man who makes the initial expense must necessarily be at more expense than the one who comes after him. We find this in building houses. For instance, in building houses at Gary, the first year's houses cost much more than the second year's work. The saving the second year was astonishing, and it was due to the fact that a trained organization had been developed the second year, avoiding delays and in many ways effecting savings.

The point we have tried to bring out in the paper is that in concrete we have a material from which we can get results. The only real lesson we have tried to teach is that in

wire was hung from the middle of the dome inside the building down to the floor of the rotunda, and on the lower end of the wire was hung a 25-pound plumb bob. In the lower point of the weight was inserted a lead pencil, the point of which just touched the floor. A large sheet of paper was spread out beneath it. As the dome moved, it dragged the pencil over the paper every day. The mark made was in the form of an ellipse six inches long. The dome would start moving in the morning as soon as the rays of the sun began to act upon it; and slowly, as the day advanced, the pencil would be dragged in a curve across the paper until sundown, when a reaction would take place and the pencil would move back again to its starting point. But it would not go back over its own penciled track, for the cool air of night would cause the dome to contract as much on the one side as the sun had made it expand on the other, and so the pencil would from the other half of the ellipse, getting back to the original point all ready to start out again by sunrise."

In the three movements affecting tall and heavy buildings we have, then, particularly in the expansion and contraction movement which is of daily occurrence, and which affects skyscraper buildings as well as all other tall structures, a condition which must be taken into consideration when planning the buildings. Lines of steam pipes, stacks of draining pipes, lengths of water pipes, vacuum cleaning pipes, refrigeration system pipes, electric wire conduits and the various networks of tubing which cross and criss cross inside of a building will naturally be more or less affected by the movements of the building; and if long life is expected of these various systems of piping, they must be so installed that they can "give" under the movements of the building without damage to the piping, and sufficient to compensate for the change of position.

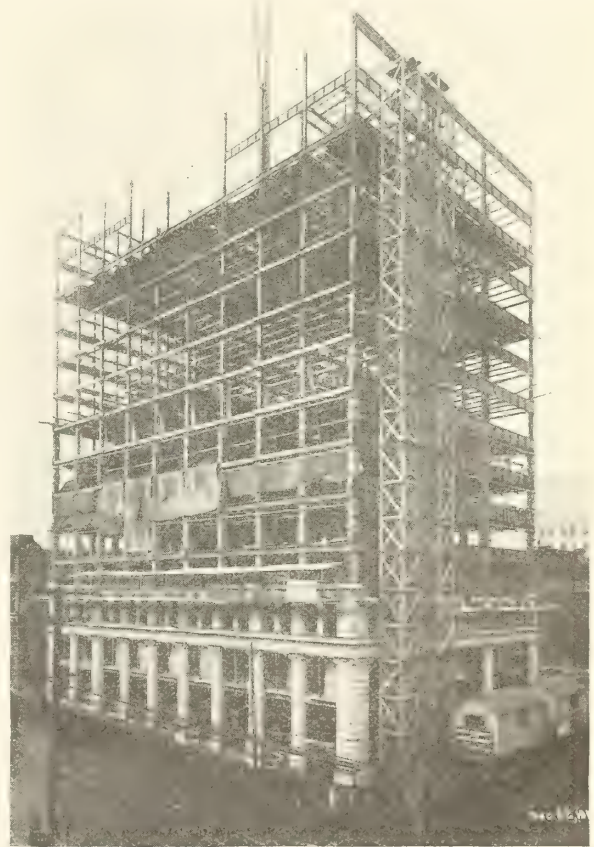
Besides pointing out the necessity for flexibility for the piping systems in tall buildings, the movement of buildings shows how desirable it is to have solid foundations the footings of which extend down to bed rock. Floating foundations are all right for some kinds of buildings, but for the skyscraper type there is nothing so good as the solid rock of old Mother Earth.

Blasting pole-holes in frozen ground has proved more economical than hand digging to the Marion Light and Heating Company, of Marion, Ind. Whenever the ground is frozen to a greater depth than 2 ft. this company digs the hole, exact size, about 15-in. deep only. With a long-handled auger a hole large enough to admit a stick of dynamite is bored about 30 in. deep. It has been found that three-quarters of a stick of dynamite will excavate a uniform hole to the desired depth of 5 ft. An average saving of 15 to 20 per cent. over the cost of manual digging has justified this method.

Freight traffic through the two United States and Canadian canals at Sault Ste. Marie in 1913 was the greatest in the history of these waterways, according to a recent report by L. C. Sabin, general superintendent of the United States canal. Freight totalling 79,718,344 short tons was handled during the season, or 7,245,668 tons more than during 1912. Only three commodities show decreases—lumber, copper and manufactured pig iron. Vessel passages numbered 23,795, as against 22,778 the previous year. The number of passengers carried totalled 77,191, as compared with 66,877 in 1912.

The New Weart Block, Vancouver

THE accompanying view illustrates in striking fashion the proportions of the new fifteen-storey Weart Block, the largest building at present under construction in British Columbia. This structure is being erected in Vancouver at the corner of Hastings and Richards streets, unquestionably one of the very best sites for an office block in the city. The frontage on Hastings street measures 78 feet and the depth on Richards is 120 feet. The foundations have been carried to rock 25 feet below grade and the basement is fully waterproofed. The construction consists of a heavy steel frame and concrete, the exterior facing on the three lower storeys being terra cotta with a polished granite base. The succeeding eight storeys will be of face brick, and the exterior of the four top storeys is to be treated in



The 15-storey Weart Block, Vancouver, under construction.

terra cotta. The spaces between the piers of the two lower storeys are to be finished in marble and bronze. The main entrance corridor has been designed in the same architectural style as the exterior, the walls and floors being of marble with bronze trimmings and ceilings of oak beams and panelling. The main floor is planned so that the corner can be utilized by a banking institution with the main entrance on Hastings street.

The main corridor will be entered off a general vestibule 25 feet wide, which leads to the basement stairs on one side, and the bank entrance on the other. The corridor floors will be of terrazzo tile, with marble borders and oak will be employed as interior finish throughout. The typical floor will be occupied by thirty offices. An approximate expenditure of \$700,000 has been estimated for the building, which is being erected by the Canadian Ferro Concrete Company, after plans by Messrs. Russel, Babcock & Rice, Vancouver.

Organizing and Executing the Construction of a Reinforced Concrete Industrial Building—Part II

By Leonard C. Wason

THE contractor is very largely a broker buying materials to be incorporated in a building. Some materials are easy to buy and some require a detailed knowledge of the materials themselves and also of the estimate and contract and the relation of one class of material to another. Therefore there is a distinction made between routine buying and experienced buying. Of the routine buying, some can best be done locally from the job and some from the main office of the company. There has been compiled a complete list of all materials which enter into a job, and then it is decided which of the routine items can most advantageously be bought by the main office and which by the job superintendent, and written instructions are prepared for these items.

Lumber and steel schedules are generally the first to demand attention. Lumber used in contact with cement is almost always ordered planed four sides. A correct ordering schedule for lumber cannot be made, of course, until the work of detailing forms is nearly completed in the drafting room. It is possible, however, to make an approximate schedule for canvassing for prices. By referring to standards we are generally able to tell in advance what sizes are wanted, and are ready to order material forward as soon as centering details are completed. As lumber arrives the material of different dimensions, qualities and finishes is piled by a prearranged plan worked out in the office handy to the woodworking shop and given numbers or letters obtained from the key plan.

The steel is taken off the plans by one man and checked independently by another. This schedule is then studied in regard to reducing the variety of lengths, and frequently these can be reduced to one-fifth of the number shown on plan. It is usual to order a schedule of bars $\frac{3}{4}$ in. and larger in multiples of 6 in. and to buy steel $\frac{5}{8}$ in. and under in the longest lengths that can be put on a single flat car, and cut it up on the job. The largest sizes recommended are $1\frac{1}{4}$ in. square and $1\frac{3}{8}$ in. round; the smallest $\frac{1}{4}$ in., all sizes to be multiples of $\frac{1}{8}$ in. On one large job there were over 400 different lengths of bars shown on plans, and by scheduling large bars in multiples of 6 in. and ordering small bars in long lengths, as above described, the mill order was reduced to 46 different lengths. This method only increased the weight of the order so as to cost \$18 in excess of the exact schedule taken from the plans, a sum saved many times over in the greater convenience of sorting and handling the steel. The manufacturers are required to deliver the small bars in bundles weighing from 125 to 145 lbs.; this insures the men getting a load of proper weight for greatest efficiency.

A study of comparative costs on different buildings indicates that about 35 per cent. of the money spent is for labor, over one-third of which is consumed in the making up, erection and stripping of forms. This, combined with the fact that lumber and labor are continually advancing in price, would indicate that a very careful study devoted to reaching the greatest simplicity and regularity in making up panels, and of using the lumber with the most efficiency, is a vital factor in low cost work. By "panel" is meant several boards cleated together so as to be handled as one

piece. To gain this efficiency the study of the forms should not be left to carpenters, but it should be the sole work of a corps of men trained to think forms all the time.

The Plant

Study of the amount and location of mechanical plant has to be made immediately after the contract is awarded if work is to be started promptly, as part of it is put into operation with the very beginning of construction. As a good deal depends upon the amount, design and promptness of delivery, so far as economical construction goes, the best thought of the whole organization is put on the subject. For instance, one of the younger men made a study for a large job on the basis of a storey a week. To obtain this rate one mixer and two storeys of forms more were required than if the progress was slowed down to a storey in nine working days. Such speed was not demanded. A conference of all hands corrected the first study, making an estimated saving in job cost of about \$10,000.

The method of distribution of concrete through the building requires some consideration. If a building is compact and large masses are placed within a limited area, spouting is desirable. If the building is spread out and quite small quantities of concrete used, two-wheeled pushcarts are used, while if large quantities are required over quite an area, industrial tracks laid on horses so as to elevate them about 18 inches above the forms are run over the latter to distribute concrete a batch at a time.

After the job superintendent is determined upon, he is taken into consultation for every step which follows. The selection of all his subordinates is made in co-operation with him—assistant superintendent, clerical force, carpenter, labor, concrete, steel and other bosses; the principal mechanics and even the leading laborers are all selected in advance from among those working on other jobs. The superintendent, where possible, is given at least a week to study plans and specifications in co-operation with his principal assistants and the office force, before anybody appears at the site of the work except for the mere purpose of studying local conditions. By this time a well-defined plan has been worked out as to the sequence of various operations, the type, size and location of the mechanical plant; schedules of the materials first needed have been made and orders placed, so that by the time actual operations begin in the field the plans are so matured that there are few false moves. The peak of the superintendent's load is the first few weeks during the organization and starting the work. During this period he should have his full executive force, although each subordinate may not at that time be doing nearly as much as he will be called upon to do later.

Planning, Routing and Cost Accounting

During the early stage of actual construction the superintendent makes a careful study of the handling of the work from the beginning to the very end, making a detailed schedule of work along the general lines which had been previously determined in the office.

The job office work is in charge of a chief clerk, who, in addition to overseeing the work of the materi-

al clerk and timekeeper, has also charge of the cost-keeping. He figures from the time sheets the cost, of which two records are kept, one for the superintendent's use in card index form, covering every single item on the job, the other considering only the large items, such as concreting floors and columns, placing reinforcing steel and for work for floors, columns and beams. The latter costs are recorded on cross-section paper. These diagrams are posted where the man who has full charge of each item can consult same when convenient for him. The foremen take a particular interest in these. Figures meaning a little larger or smaller cost convey some idea to them, of course, but the meaning of a line traveling upward or downward and above or below a red line representing the desired cost line is grasped very easily. Keeping the foremen keenly awake to the cost of the work they are doing has not been, so far as can be seen, detrimental to their turning out good work. It should always be accompanied, however, by more rigid inspection in the beginning and explained so that they may definitely understand that any lowering of cost shall be considered detrimental to their interest unless the quality remains equal to the standard.

Moving Boss and His Gang

The moving boss and his gang are a very important factor in the success of routing. He must be a painstaking, tireless fellow, who has sufficient intelligence to see that the men under his charge do exactly as told, taking the correct materials, carrying them to the proper place and laying them right end to and right side up, as per the written instructions from the routing foreman. The men under his direction must be active, strong and energetic—the pick of the laborers, because they have to do a great deal of moving about and are in small groups or alone; therefore, they are not under the close eye of their foreman. They must be men who will work without being too closely watched. This boss receives instruction as to how such laborer will do his work from the operating foreman.

The method of task and bonus pay is frequently followed on work, and by means of data previously obtained it is possible to ascertain very accurately what the correct best time should be for the making up of any particular panels by a pair of good carpenters. For doing the work in this tasked time an increase over their usual hourly wage is paid of from 25 to 30 per cent. On the erection of the form a similar method is followed. All material is moved from the stock piles to the point of erection by common laborers, under the leadership of an efficient moving foreman. The foreman receives all instructions on a written slip. The planning department is able at all times to make sure by so doing that the carpenters have the material they want, when they want it, and where it will be most convenient for their use. No carpenters are allowed to carry lumber, but are restricted to doing real carpenter work.

In spite of the wages of carpenters nearly doubling in twenty years while the equality of intelligence of those who do the work is less, because house and finish carpenters will not do this kind of work as formerly, and in spite also of the great advance in price of lumber, combined with a falling off in quality, the unit costs obtained by the above system are materially lower than when the job superintendent was left to himself. The total gain in efficiency is about fourfold.

It is unnecessary to protect form work from the rain, as usually it is only possible to get green lumber, whose tendency is to shrink out of shape rather than swell. Rough concrete never need be protected from the rain before setting, only from the concentrated run-off over some portion of the work which might wash deeply the cement out of a small area.

A troweled finish, however, must be protected against pitting by the rain or damage by concentrated streams. This is usually done by tarpaulin, which consists of 12-oz. cotton duck rendered waterproof by being saturated with "Preservo," after being made into covers twenty feet square. These are supported by temporary frame. They are somewhat of an inconvenience to the finishers, and decrease the amount of work which they can do.

If there is to be an unavoidable delay in placing concrete after forms are erected it is wise to protect them from the sun, because they shrink so as to open up cracks, which permit the mortar to escape, leaving a bad surface. Rough concrete does not require any protection from the sun, with rare exceptions. It is usual to cover up a granolithic finish for at least five days. The materials most available and most economically used for this purpose are rough bags, such as come around bales of cotton, or wool, shavings, sawdust, and sand. The object of these is to retain the water which is put upon the surface, which may thus be maintained at a fairly uniform lower temperature than direct sun action permits while setting.

Mr. Wason considers it unwise to spray bare concrete in the hot sun, and the use of roofing paper is but little better, because it retains moisture but a very short time. The water falling on a surface heated directly by the sun chills it suddenly, causing it to shrink, and may cause the very cracks which one is trying to avoid.

The aggregates must be free from frost when mixed. A live steam pipe can be shoved into the sand pile, the escaping steam heating it and removing all frost. The same may be done with the stone, but a canvas should be thrown over the top of the pile to retain the heat, which more readily escapes. Where a considerable amount of heating is provided for in advance, steam pipes are laid on the ground, and stone as received is dumped upon them. Then there is a canvas thrown over to prevent storms getting into the pile, and to retain heat. The frost is thus easily and economically removed.

Salt is frequently used in the water to lower its freezing point. It is seldom worth while to heat the water itself. Little care need be used to prevent mass concrete from freezing, as the frost will usually only strike to a depth of about 1 inch. Buildings are inclosed with tarpaulin tied on to an outside staging, and the inclosed space is heated with salamanders burning coke. Sometimes it is possible to use steam.

Frost is removed from form work by the use of salt and steam, and if the concrete surface is left rough it is common to sprinkle the top surface with salt to prevent freezing. In winter it is very common to put the finish on as a separate operation, after the building is inclosed and not as an integral part of the construction, on account of the danger of freezing. When it is put on, it must be kept from freezing for the first forty-eight hours.

The expense of protection against the weather is not very great, and good results can be so surely guaranteed that it is not usual, Mr. Wason states, ever to discontinue work on account of cold weather.

Erection Features of the Quebec Bridge

St. Lawrence Bridge Company's Elaborate Equipment—Erection Travelers—Systematic Method of Building Various Parts of the Structure.

THE new Quebec Bridge is located at Neilsonville, at the site of the old structure, which is about eight miles from Quebec. The bridge has a center span of 1,800 ft., consisting of a suspended span of 640 ft. and two cantilever arms of 580-ft. span each; two anchor arms of 515-ft. span each; and approach spans, the total length of the structure being 3,240 ft. The new bridge is much heavier than the old structure, which made it impossible to use the old piers. The new piers for the main span are each 67 ft. south of the location of the old piers. The bridge has a clearance of 150 feet above high water.

The new bridge was designed and is being constructed by the St. Lawrence Bridge Company, which was organized to build this structure. The designing office is in Montreal, and the bridge shop is about five miles from Montreal, being about one mile from the Dominion Bridge Company's plant at Lachine Locks. The capital stock of the St. Lawrence Bridge Company is held equally by those interested in the Dominion Bridge Company and in the Canadian Bridge Company, and many of the officers of the new company are former employees of the latter companies. The bridge shop of the St. Lawrence Bridge Company is a new structure, and was designed expressly to build the new bridge. It contains considerable special machinery designed to fabricate the large sections of the new structure. The plant was built at a cost of about \$1,000,000, and must be paid for out of the profits of the new Quebec Bridge.

The St. Lawrence Bridge Company has an elaborate equipment at the bridge site. The various bridge sections are unloaded from the cars by means of a large traveling crane, and are transported to the bridge site over the company's system of tracks. There is now stored at the site a considerable amount of fabricated material, principally for the floor system. The piers and abutments are now completed and the approach spans are in place. For constructing the piers at the north end of the bridge an inclined railway was built on each side of the north abutment. The material for the piers was transported to the site, where it was transferred to the inclined railway, which in turn carried it to the location of the pier. The material was then picked up by derricks and set in place.

Each of the cantilever arms is to be erected as a separate structure, with its individual erection equipment. The center span, which will weigh about 6,000 tons, will be assembled on barges near the bank of the river. It then will be floated into position, and by hydraulic power will be raised to its final position in the structure.

Each erection traveler for the cantilever arms is constructed of steel and is about 200 feet in height. The traveler is carried by four trucks having six wheels each. At its base it spans two railroad tracks, on which are transported the cars containing the material for the bridge. The total weight of each of these travelers is about 840 tons, although an attempt was made to make this weight a minimum by constructing the crane girders which project over the traveler of nickel steel.

The hoisting equipment of each tower is both elaborate and diversified. On each of the four corners there is a 90-ft. 15-ton derrick, and on top of the traveler there are two traveling cranes, each crane carrying two 55-ton main hoists and two auxiliary gantry cranes. On each auxiliary gantry crane there are two 5-ton hoists. All motions are motor-driven, except the bridge travel of the auxiliary gantries. The main traveler will be moved along the cantilever arms by using, temporarily, two of the 50-h.p. motors of the 15-ton derricks. Table I shows the distribution and capacity of the motors for one traveler. It will be seen that 26 motors, with a total horsepower of 752, are used for hoisting operations.

On each side of the river, high tension hydro-electric power is stepped down by transformers, and is converted into 250-volt, direct current at two sub-stations, one on each side of the river. These sub-stations are supplied by separate systems, and are connected by submarine cables. Each sub-station is of sufficient capacity to operate all the motors on both sides of the river, including those required for the air compressors, which requires about 1,600 horse-power.

Direct current is used exclusively on the erection towers, as it affords better control than alternating current, and permits the ready employment of dynamic braking for the lowering machinery. The lowering of some of the heavy members used in the construction of the cantilevers would generate an excessive amount of heat in any type of friction or mechanical brake. By dynamic braking is meant that the motors are temporarily converted into generators during the lowering operations, the different speeds being obtained by inserting or removing a series of resistances. This enables most of the heat to be dissipated in a cast grid resistance, which is located in the base of the main traveler.

The returning effect of the dynamic braking action, as applied to the lowering of a load, exists practically only while the motor armature is rotated. It therefore requires a separate means to hold the load stationary. For this purpose a magnetic brake is placed on the armature shaft to lock the motor when the controller is brought to the "off" position. On some of the hoist motors safety devices are provided to stop the motor automatically if the operator should allow the load to over-travel. A large switchboard is installed in each main traveler, and numerous push buttons are located at points easily accessible to the operators, by which they can open or close the motor circuits.

The two main trusses are to be erected symmetrically on each side of the main traveler. It is planned first to erect the north anchor arm over falsework, using one of the travelers. After this arm has been erected the south anchor span will be erected by using the second traveler. At the same time that the south anchor arms is being erected the first traveler will be at work on the north cantilever arm, and this will be finished at about the same time that the south anchor arm is completed. The first traveler will then be taken down and reassembled at a point about two miles below the bridge site, where it will be used for erecting the suspended span on barges. In the meantime the

second traveler will be at work erecting the south cantilever arm, and it is planned to complete the erection of this arm and the suspended span (on barges) at the same time. The suspended span then will be transported to the bridge site and raised into place.

An operating platform will be built on each traveler at a height sufficient that a clear view can be secured of the material as it comes from the flat cars and is elevated into its final position. A house will be built in the center of this platform to protect the control apparatus, except that portion which is directly operated by the workmen—this will not be enclosed. Six men will be stationed on the operating platform and two men on each of the main cranes at the top of the traveler. To secure the proper co-operation between the widely separated workmen, a telephone system will be installed with a central switchboard and permanent connections with the shore. An electrically operated passenger elevator will serve the different levels of the traveler.

The following is a brief description of the method of erecting any typical part of the structure: The member first is brought beneath the traveler on flat cars, and is elevated and placed by two, or possibly four, of

the 55-ton main hoists. The pin is then brought into position by one of the five-ton auxiliary hoists. A large ram for driving the pin is then brought into position by another five-ton auxiliary hoist, and the pin is driven into position.

It is expected that work can be prosecuted only for about eight months of the year. With this condition in mind it is expected that the bridge will be completed in 1918.—**Engineering and Contracting.**

Water purification at Albany, N.Y., where Hudson River water is passed through a sedimentation basin, preliminary filters, slow-sand filters and finally receives a dose of hypochlorites, cost \$6.19 per million gallons, including pumping, during 1912, according to the report of Mr. J. B. Kilbourn, superintendent of the Bureau of Water. This cost is apportioned among the following items: Pumping, \$3.19; sedimentation basin, \$0.02; preliminary filters, \$0.56; slow-sand filters, \$1.15; laboratory, \$0.61; hypochlorite, \$0.35; superintendence, \$0.31. During the year 7,600,456,000 gallons of water were treated. The average rate of filtration was 3,535,000 gal. per acre for slow sand and 81,000,000 gal. per acre for pre-filters.

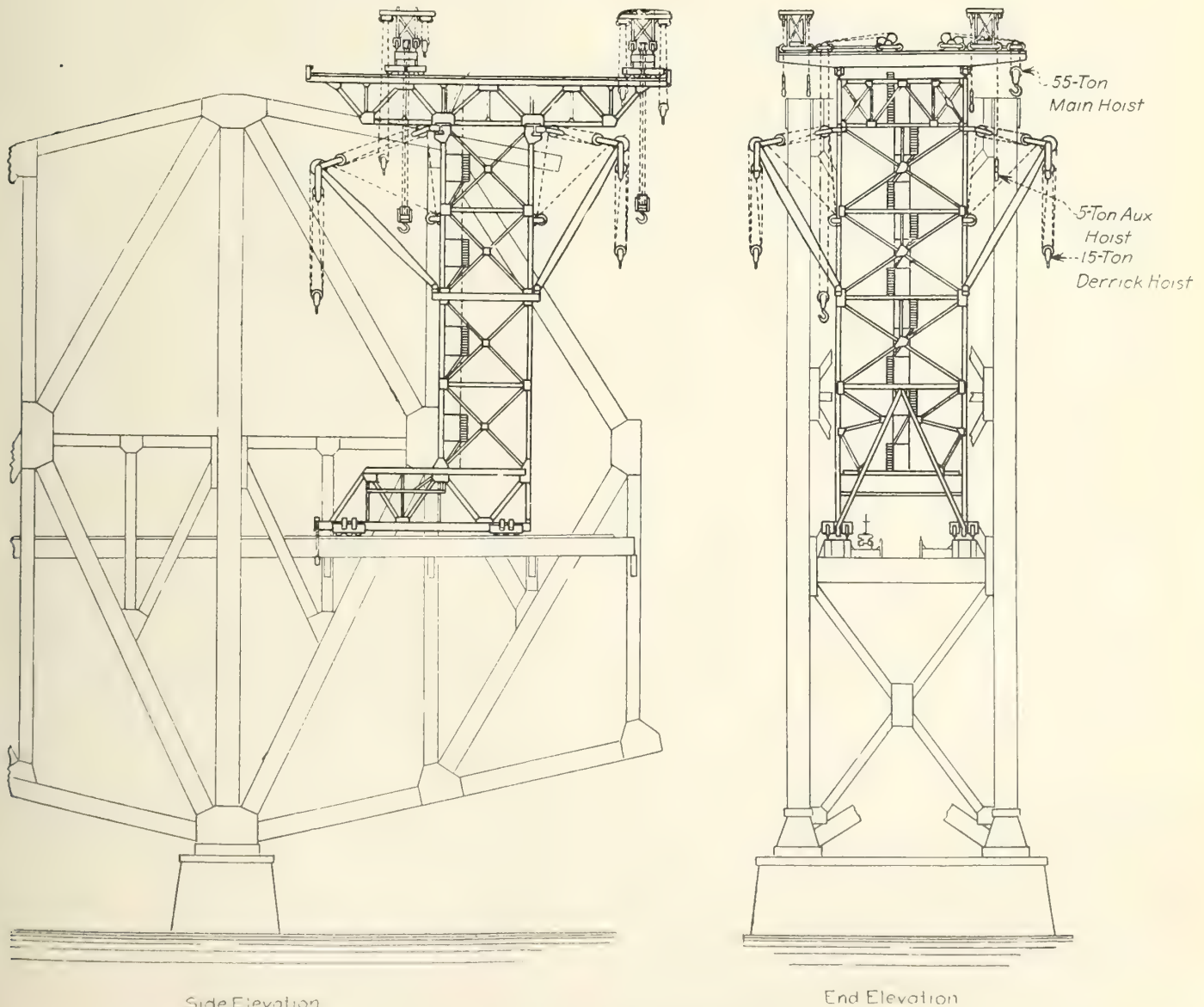


Fig. 1. Side and End elevations of erection traveller for new Quebec Bridge, showing type of Traveller and location of motor hoists.

Wood and Asphalt Block Pavements*

Failures due to Lack of Provision Against Bulging—Inadequate Attention given to Methods of Laying—Manufacturing Shortcomings

By H. H. Schmidt

PAVEMENTS are supposed to be designed to meet certain requirements. No one pavement is known that will meet all. If one pavement is best suited to the most severe conditions, it is not necessarily the best pavement for less severe ones. Somewhere in the scale of pavements, between the ideal one and the so-called pavement which is destroyed in a comparatively short time under light traffic and by the action of the elements, might be placed all known pavements in the order of their value. I will not attempt to tell you just where, in this scale of pavements, wood and asphalt block pavements should be placed, though I will say that neither one is the ideal pavement, except in the opinion of the respective manufacturer, and still both of them stand well up in this scale of pavements.

Wood Block Pavement

Wood block pavements are suitable for streets where the factor of elimination of noise is an extremely important one, and where the traffic is quite heavy. Probably every one who has had considerable experience with this class of pavement has obtained many splendid results, but also some failures. These failures in wood block pavements are entirely different from failures in any other class of pavement. They are due almost invariably to the expansion of the wood, and within a short time a perfect street may become a complete wreck.

Another source of great annoyance with this pavement, though not to my mind an extremely serious condition, is caused by the so-called bleeding of the blocks. This bleeding is always, where it occurs, a matter of much concern to the one responsible for the condition of the pavements. The bleeding generally ceases after the block has been down a few years. In no other pavements do we have these two conditions to contend with.

The important question, and the one which is occupying the minds of many who have to do with this class of work, is the expansion of the block. The nature of all wood is such that it expands or contracts as the amount of moisture to which it is subjected is increased or diminished. If it were possible to lay blocks in their most expanded condition, we should not have trouble with expansion after the pavement was laid, but it is very seldom that blocks are in this condition at the time of laying. For this reason we must give consideration to many matters which are involved when this class of pavement is used. Traffic, treatment of the blocks, their condition before treatment, their condition when laid, surface drainage of the pavement, the width of roadway, the amount of moisture or water to which these blocks will be exposed, and the length of time they are subjected to the wetting, are all matters which must be taken into account if failures are to be avoided.

It might be said that where failures in wood block pavements do occur, they are due to a lack of know-

ledge, or a lack of provision for the essentials which must be considered to provide against bulging under certain adverse conditions, and I look for fewer failures as these various matters are better understood and better provided for.

The specifications in use in the various localities in this country at the present time are, on the whole, very much alike, and there is no question but what they will provide for a wood block pavement which, under all ordinary conditions, will give splendid results. The important elements upon which the modern practice is based are: The character of the timber; size of the blocks; character of the oil, treatment of the blocks and method of laying.

More attention has been given to the size of blocks, character of the oil, and the treatment of the blocks, than to any other features of the wood block pavement. That they are very important questions it is unnecessary to state, and yet the character of the timber, its condition at the time of treatment, and the method of laying the blocks are more important features than the size of the blocks, the character of the oil, or the method of treatment.

We are, of course, limited to certain kinds of timber, and are pretty well satisfied that a good, sound, southern yellow pine is about the best available timber, if it is in proper condition for treatment.

As to the method of laying, this is a matter which does not seem to have been given the amount of attention which it warrants. We are not justified in using or in laying the blocks in identically the same way under all conditions, and I have been particularly impressed with the results which can be accomplished where failures have occurred, with blocks which are identically the same as the ones that failed, by adapting the method of laying to the circumstances which have contributed to cause the failure.

Specifications for laying wood block pavement should give consideration to the relation between the width of pavement surface, the treatment of blocks, and the size and location of expansion joints. The width of joints between the blocks must also be considered. No one seems to wish to commit himself on this question of width of joints. Some specify tight joints and some open joints, but this is merely a relative description, which means little or nothing.

There exist today wood block pavements laid ten and more years ago, where the blocks were laid so close that they all touched one another and entirely without expansion joints, and yet many of these pavements have never bulged in the slightest degree. On the other hand, we have some new pavements, which seem to have been amply provided with expansion joints, and which have bulged badly. In every case, however, the old pavements which did not bulge were laid on streets where the local conditions for a pavement were of the best, while where considerable bulging was experienced, the local conditions generally were bad and were not properly provided for.

A wood block pavement is one of our highest types of modern, smooth, clean, noiseless, and dur-

* Presented at the Tenth Annual Convention of the American Road Builders' Association.

able pavements. The two faults pointed out should not detract from its use, but it is essential that the bleeding be eliminated by the proper treatment with preservative oils whose properties are such that they will not cause the block to bleed, and it is further essential that the blocks be so laid that they have the opportunity to expand without bulging, if they are not laid in a fully expanded state. Intelligent investigation and experimentation will, without doubt, in time overcome both of these difficulties.

Asphalt Block Pavements

Asphalt block should not be used on heavy traffic streets, particularly where there is considerable steel tire traffic, as the life of the pavement is very short on such a street. On the other hand, they have given splendid results on automobile roads leading from the city into suburban districts.

The asphalt block pavement is particularly suited to villages or country districts not large enough to support an asphalt plant, as no plant is required for the first construction, nor for the maintenance.

Many asphalt blocks which have been manufactured in the past have been complete failures and have been the cause of creating a strong prejudice against this material. The specifications for asphalt blocks generally provide for: the size of the blocks; the composition of the blocks; the character of each ingredient; the specific gravity of the block and the method of laying.

The failure of asphalt block pavements is due to entirely different causes from the failure already described under the wood block pavements. We do not have the question of bleeding or expansion to deal with. The difficulties in this class of pavement have been to secure blocks which have been manufactured with proper ingredients, mixed in proportions which make them fit to withstand the wear and tear of traffic, and blocks which are properly moulded and compressed. The specific gravity has been considered as an index of these requirements. The size of the blocks and the method of laying are both, of course, of importance. It is essential that the blocks be of sufficient size to have stability, and that they be laid in such a way as to be held rigidly in place.

Asphalt blocks are composed of asphaltic cement, crushed trap rock, and mineral dust. Considerable difficulty has been experienced in producing a block which would answer the needs of traffic, and at the same time one which will not deteriorate rapidly under the climatic conditions to which it is subjected. The successful manufacturer of such a block undoubtedly requires a tough asphaltic cement, that is, one which will produce a block the edges of which will not "ravel" under traffic in winter, and secondly, a proper proportioning of such an asphaltic cement to the trap rock and mineral dust, so that the block will not elongate or "shove" under traffic in summer. In almost all cases where an asphalt block has failed, the failure has been due to disintegration, and the amount of asphaltic cement which the block contained was very small as compared with the amount of asphaltic cement in an ordinary sheet asphalt pavement.

A great advance has been made in the last few years in this direction, and blocks are now being manufactured which are standing up well under considerable traffic, and which at the same time contain sufficient asphalt, so that their lasting qualities will be greatly improved. Machines for moulding and compressing the blocks have also been improved, and

without question some of the asphalt blocks which are now being manufactured measure up very favorably with other standard types of pavement.

The Economics of the Water Meter*

By John Ericson †

IN 1950 Chicago will have a population of 5,150,000. The consumption of water per capita has increased from 43 gal. in 1863 to 203 gal. in 1912, or about 160 gal. in fifty years. If we assume the increase in the future at half the rate of the past, we will have in 1950 a per capita consumption of 263 gal. This will require a daily pumpage of 1,350,000,000 gallons, or, in other words, the present enormous system must be more than doubled in 38 years.

Nearly fifteen years ago the author commenced a series of careful investigations to determine the use and abuse of the water-supply of Chicago, and has since endeavored to point out the advisability of conservation and the restriction of the waste and leakage of our water-supply. The best and generally approved method for this purpose is the installation of water meters, a method that has proved economical and satisfactory in Europe and in those American cities where it has been adopted.

A statement showing the water meters installed during August and September, 1911, was prepared, and about a year later a careful comparison was made showing the effect on rates of the installation of these meters. They were 261 in number, of 5/8-in. to 8-in. size, and were set on all classes of service and in all parts of the city. They included saloons, foundries, railway stations, residences, laundries, buildings with hydraulic cellar drainers, hotels, factories, garages, milk depots, greenhouses, fish markets, office buildings, warehouses, apartment buildings, etc.

Where the difference was obtained, 124 premises showed an increase and 56 showed a decrease in the bills by the installation of meters. The total of the excess meter rates for six months amounts to \$2,885. The total of decreases, by reason of setting meters, for a period of six months, amounts to \$495, making a net increase of \$2,390, or \$4,780 as the annual compensation for the setting of these meters. These figures indicate that if the placing of meters is judiciously made, irrespective of a decrease in pumpage, the city's revenues will be increased rather than diminished.

In spite of the campaign for a restriction of leakage and waste, and in spite of the economy and satisfaction that water meters have given in other cities, so much opposition to this method is met with in Chicago that only about six per cent. of the service pipes have so far been metered.

Designs for municipal water meters have lately been perfected in the office of the city engineer, and sample meters made from these designs are now being tried. It is expected that, as soon as these meters have proved satisfactory on trial and have been adopted as standard the installation of meters on a much larger scale will be commenced.

One of the important reasons why Chicago has to pump such great quantities of water, and why there is always such urgent necessity to build additional tunnels and pumping stations, is the failure to adopt rational methods of water-waste prevention. An argument often heard is that we have an inexhaustible sup-

* Extract from a paper on "The Chicago Waterworks," in the Journal of the Western Society of Engineers.

† City Engineer, Chicago.

ply of water right at our doors and that the water should be as free and abundant as the air we breathe. If this excessive pumpage would benefit the people, there would be nothing to say about it. But, as a matter of fact, the wasted water does no one any good, and when escaping into the ground it often becomes a detriment rather than a benefit.

When it is considered that the cost for coal alone to pump the many million gallons of water in Chicago is now about \$450,000 per year, it will be seen that by reducing the per capita consumption from 203 gal. to 120 gal. per day, which amount should be sufficient for any city, a saving from this item alone would amount to nearly \$200,000 per year.

When we consider also the additional cost on the account of larger pipes required to carry the excessive quantities of water, other operating expenses, and the interest on cost of tunnels and pumping stations that could be delayed under proper restrictions, the saving per year would amount to many thousands of dollars more.

Concrete Tile Blocks Manufactured by Wet Process

CONCRETE tile blocks are being manufactured in a specially built factory in the Canal Zone, for use of the new Administration Building at Balboa. The process used is the invention of A. A. Pauley, who installed the manufacturing plant and who has granted the sole right for manufacture on the Isthmus of Panama to the United States.

The blocks are manufactured by a wet process quite different from the dry process generally used in making concrete blocks. Concrete is mixed in the plant in the proportion of one part of cement, one and one-half parts of sand, and two parts of stone screenings. It is mixed fairly wet. Each molding machine is capable of turning out four of the smaller blocks at a single operation, and three of the larger sized blocks. The forms are inclosed within a double cast-steel lining with a space between for the priming steam. In molding a block the first step is to insert at the bottom of the form a cast-iron frame having the shape of the solid portion of the required block. This acts as a base and support for the block. The valve from the concrete mixer is then opened and the concrete is allowed to flow down a short chute to the top of the mold. A workman then diverts the thin or wet concrete with a trowel into the crevices around the forms until all are filled level with the top. Steam, which may be graduated to the desired pressure by a series of valves located beneath the machine, is then turned on for a period of four minutes, at the end of which time the concrete has so stiffened that it will stand alone and is turned out of the mold by means of a crank, which pushes out the interior form. The blocks are then lifted from the mold and transferred to short lengths of wooden planking and placed on receiving racks, which are on a combined moving platform and elevator system, which carries the blocks to the curing room.

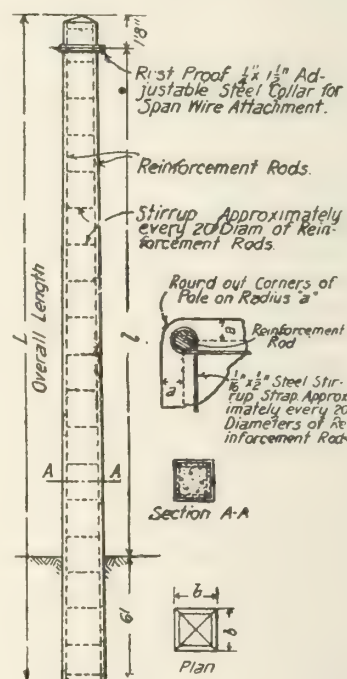
The curing room consists of 24 galvanized-iron compartments, each about 45 ft. long, 4 ft. wide, and 8 ft. high, entirely inclosed. In these rooms the blocks are given their perfecting treatment, which consists of a combined steam and water dripping process, devised to facilitate the setting up and hardening of the blocks, so that within 48 hours they are ready to be removed to the storage yard.

Each unit of the plant is operated by individual electric motors. The steam is generated by two boilers located in a shed outside the plant.

Blocks to be made are 12 x 12 x 18 in., for foundations or walls, 8 x 12 x 12 in. for main walls, 8 x 8 x 16 in. for corners, 6 x 12 x 12 in. and 4 x 12 x 12 in. for partitions, and 3 x 12 x 12 in. for interior columns.

Suggested Design for Reinforced Concrete Poles

A suggested design for concrete poles was included as a part of the report of the committee on power distribution presented before the American Railway Engineering Association at the recent annual convention. The committee reported that not much information was available on the subject of reinforced concrete poles, and the design, which is shown in the drawing reproduced herewith, was presented only in a tentative way for experimental purposes. "An effort was made to have a simple design," the committee states, "and it is fully believed that that presented will



Experimental design for reinforced concrete poles.

meet the ordinary requirements for a trolley line. No doubt experience will determine a number of ways in which the pole may be improved." It is intended to serve the same purpose in trolley line construction as the wood or steel pole ordinarily used. This particular design has not been manufactured or tested in actual use, as yet.

Specifications accompanied this section of the report, of which those parts pertinent to the design of the pole are as follows:—

"Poles may be manufactured in wooden or steel forms, cast in horizontal position, and will require great care in handling during erection. The area of reinforcing rods shall constitute practically 4 per cent. of the base area of the pole, and shall be made up of four reinforcing bars placed as shown in Fig. 1. The modulus of elasticity of the reinforcing steel shall be at least 30,000,000. The longitudinal reinforcements will require stirrups at intervals of from twenty to fifty diameters of the reinforcing rods. These stirrups may be 1/4-in. rods, or 1/16-in. by 1/2-in. straps, and

should be bound around the four rods with a few inches extension of the ends to insure anchorage. By using sufficiently heavy stirrups and giving a complete turn about each longitudinal rod, the reinforcement can be formed into a self-supporting frame that will require only an occasional wooden spacing block to hold it in position while concreting the blocks to be removed as the concreting progresses. The span wires may conveniently be fastened to the pole by an adjustable collar of steel, or an aluminium fixture may be embedded. If steel is used, it should be approximately $\frac{1}{4}$ -in. by $1\frac{1}{2}$ -in., adjustable and rust-proof. Steel pin pole steps may be inserted, and gains for cross-arms may be moulded when pole is being manufactured, as desired. The pins used shall be rust-proof. The concrete shall be made of Portland cement, meeting the test requirements of the American Society of Mechanical Engineers, of clean, sharp sand, and crushed stone, which shall be clean and free from dust, and not more than $\frac{3}{4}$ -in. in its largest dimension. Clean washed gravel of the same size may be used in place of stone. The mix shall be of a richness of at least 1 part cement, 2 parts sand, and 4 parts stone."

The Canada Cement Company's Great Plant at Pointe aux Trembles, Que.

THE accompanying illustration is reproduced from a photograph of one of the most extensive and best-equipped cement mills in the world—the new plant of the Canada Cement Company, Limited, at Pointe aux Trembles. It is hoped to publish a detailed description of the plant in a later issue of this journal, but we give the following particulars from Industrial Canada, to whom we are indebted for the illustration.

The establishment consists of a crusher building, a rock storage building, a building for drying raw materials, a mill for grinding raw materials, a kiln building, a storage house for clinker, a mill for grinding clinker, a storage house for gypsum and five cement storage buildings, capable of storing one and a half million barrels of cement, covering an area of forty acres. The materials are obtained from quarries situated alongside of the mill and consist principally of a

rock known as "Cement Rock." Coal is received by boats and is unloaded by means of a bridge crane. A private railroad, known as the Pointe aux Trembles Terminal Railway, runs from the dock to the mills and has connections with the C. N. R. main line and with the Montreal Tramways Company. Shipments are made at the present time either by rail, trolley or boat. The daily output amounts to 12,000 barrels per day, or 48,000 sacks. In the manufacture of this cement approximately 200,000 tons of coal are needed yearly.

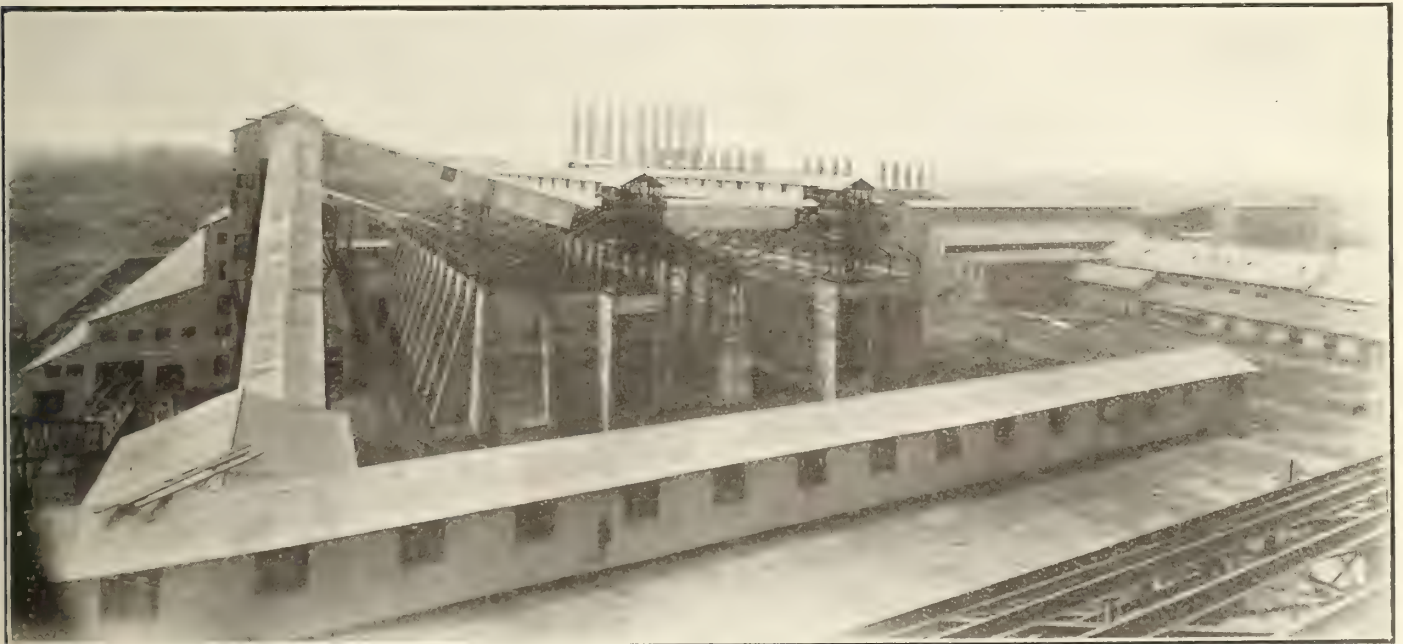
A New Ten-Storey Building at Regina

SKY-SCRAPERS in Regina—the capital city of Saskatchewan, are limited to a height of ten storeys. At the present time there is only one structure in the city that attains the maximum height, namely, McCallum, Hill & Company's building,



McCallum, Hill & Company's Building, Regina

recently completed. Originally it was the intention of the owners to build an eight-storey structure, but when



The Canada Cement Company's new mill at Pointe aux Trembles.

the city council fixed a limit of ten storeys, the company decided to add two additional storeys.

The McCallum, Hill & Company's building is not only equipped on the most modern style, but is well lighted and of pleasing design. The ground dimensions are 75 feet by 120 feet 6 inches. On the exterior, stone is used entirely for a height of two storeys, when brick of a color similar to the stone is used for the next six storeys. The top two storeys are brick trimmed with stone. The appearance thus given is as though stone were used throughout. The cornice and flashings are of copper, while iron panels are used between the brick columns above the second floor. Ornamental cluster lights are used for lighting the sidewalk around the building, while at the top pilot lights have been installed.

The building is equipped with private water and light system. The steam is first used in the generators and then in the heating system. From the generators are operated the motors, which provide the light, work the elevators and pump water. The owners sell lighting power to tenants at the same rate charged by the city.

In the basement is arranged the boiler room, pump room, engine room and a billiard room and barber shop. Apart from the offices on the main floor, provision is made for a vestibule and a public hall leading to the elevators. The walls are of marble to a height of four feet, the remainder of the walls being given up to large windows. The offices adjoining are in full view of the public using the halls. The remainder of the building is given up entirely to office suites.

The building is fireproof throughout, the walls and ceilings being of tile construction. The floors of all corridors above the ground floor are of terrazzo. The floors of the corridor and lavatory on the ground floor are of marble mosaic in three colors, the body white, with a selected border in green and buff. The stair treads and landings are of Italian marble. The vestibule and corridor on the ground floor, and one side of the stairway, from the ground floor to the first floor, are of polished white Italian marble wainscoting, four feet in height, with eight-inch base and four-inch cap of green verde antique marble. Messrs. Storey & Van Egmond, Regina, were the architects, and Messrs. Wilson & Wilson, Regina, the contractors.

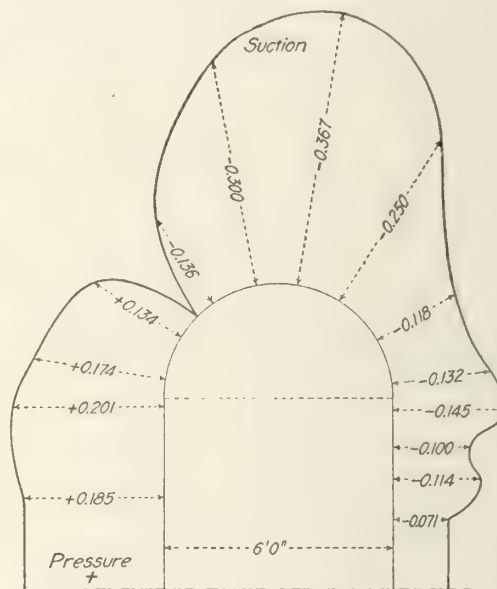
There is coming into use in Germany a cheap and ready method of asphaltting a stone-paved street which is showing good results. The spaces between paving blocks are cleaned out to the depth of about an inch, and then a layer of melted asphalt is flowed over the street surface, the depth of the layer being about 1 in. Before it is cooled, sand is sprinkled on and the surface is smoothed. At Frankfort a section of this kind is now laid, and it appears to stand the wear remarkably well. Should the method prove a success in general practice, it will afford an excellent means of deadening the noise of city traffic at a small expense. It is quickly carried out, and it need not stop the circulation on narrow streets for any length of time. Moreover, repairs are easily made.

Fireproof wooden shingles are being made in the forest products laboratory of the University of Wisconsin at a cost of \$15 per thousand. The method consists in forcing into the wood, under pressure, such chemicals as ammonia sulphate and ammonia phosphate.

Wind Load on Buildings*

EXPERIMENTS on a roof of semicircular section of 6-ft. span and 10-ft. length, covered with tin, mounted on walls 5 ft. high indicate that the common assumptions in regard to wind load do not come very near actual conditions. Results of the experiments led the author to propose a conventional loading of the full-wind specification over 90 deg. of the roof.

After each set of observations the roof was lifted and 6 inches of the walls were taken off. At the middle section of the building $\frac{1}{2}$ -in. holes were bored about one foot apart in walls and roof, the row extending from ground to ground. In the roof the holes had a short nozzle soldered on the inside. Tubes of rubber and glass led to a pressure-registering instrument consisting of a series of inclined glass tubes, one end of which was connected to a small reservoir and



Wind Pressure on Model House.

Figures in lbs. per square ft. Wind blowing from left to right.

the other end to the tube from the holes. The gauge tubes were mounted in a frame, one over the other, with a scale in the centre. Photographs were taken of the meniscus to obtain simultaneous readings on all the gauges and at the same time that wind velocity observations were made, 30 ft. to the windward side with a Pilot tube, which had been calibrated with a thin plate. Kerosene was used in the glass tubes and reservoirs. The reservoirs were placed in sloping rows on the back of the frame so that when the whole instrument was tilted $\frac{1}{4}$ in. in 10 in. a horizontal plane passed through the centre of any tube at the middle would also pass through the middle of the walls of the reservoir of that tube.

The point of reversal of wind load from pressure to suction varied from 25 to 50 deg., but the average of seventeen readings indicate the point is at 45 deg.

In applying the unit loads it was proposed to draw on the cross-section of the building a semicircle with the half span as radius, placing the centre of this semicircle at such distance below the peak that the area of the cross-section of the building above the base of the semicircle is the same as that of the semicircle. The 45-deg. radii will then intersect the roof at the point of change in the loading units.

*Abstract of Paper by Prof. Albert Smith, of Purdue University, presented before the Western Society of Engineers.

Unique Features of New Toronto Theatre

THE most recent addition to Toronto's theatres is the new building which was opened for public entertainment a few weeks ago by the Loew Theatre Company of Canada. The construction of the building is unique in the respect that it contains two theatres, one above the other, so arranged that both can be occupied simultaneously. The main entrance is on Yonge street and the buildings extend back to Victoria street. The Yonge street building is two storeys in height, having a frontage of 38 feet, half of which is occupied to a depth of 100 feet by the main entrance lobby and also by a store which it is the intention to rent as a restaurant or tea-room. The front on Yonge street is composed of white marble columns, with Canadian granite base. The space above the first storey is entirely of terra cotta, and as a finish to the pattern panels in the brickwork on the Victoria street side terra cotta is also used at the corners. The style of architecture is modern and in this respect is uniform with all the theatres controlled by the Loew Theatre Company.

The building is of brick and steel construction, and the floors, balconies and roofs are of reinforced concrete. In the construction, yellow pressed brick and panelled brickwork was used. The coping is constructed of ornamental corbelling, giving the building an artistic appearance.

The lower theatre is 160 ft. by 100 ft. and the lobby 37 ft. by 160 ft. The lower theatre, including the balcony, has a seating capacity of about 2,300, that of the upper theatre being about 1,600. There are seven tiers of dressing rooms, laid out on the principal of three to each tier. Each theatre possesses its own separate stage, balcony and other fixtures and equipment, and such is the unique arrangement of both the theatres that a performance can be given on the lower stage and immediately transferred to the upper stage by means of a large freight elevator, staircase, etc.

Between each auditorium floor and the balconies, toilettes have been provided. The basement in the rear of the auditorium is utilized as a smoking room and lavatory. In the basement around the entire exterior of the auditorium is a pipe tunnel, five feet wide, which contains all the heating and plumbing pipes, at the same time serving as ducts for the passage of heated fresh air through mushroom heads into the floor of the main auditorium. The exhaust from the heated air is located in the centre of the main ceiling, thus affording a suitable outlet beneath the floor of the roof garden in the west wall.

The lobby in the Yonge street section is fireproof tunnelled, with brick walls on either side and concrete floors and reinforced concrete arches above.

The interior of the building is executed in a manner after the style of most theatres. The ceilings and cornice are finished in a handsome design of ornamental plaster. Similar treatment is applied to the staircases and elevator halls at the rear of the main lobby before entering the auditorium. The main lobby itself is finished in a colonnade of artificial marble or scagliola, tiled floors, bases, etc., the ceilings being very effectively treated in ornamental plaster.

An innovation is the provision of a roof garden. Entrance to the garden is provided by two elevators leading from the main staircase lobby and provision is made for a third elevator if required. A pleasing outdoor aspect is given to the garden by the display of artificial tree and foliage effects.

The important problem of exit facilities has received careful attention at the hands of the owners, with the result that the provision made in this respect is sufficient to ensure absolute safety. Around the main theatre at the west and north ends are the exit courts leading to Victoria street. Exits and all fire escape stairways are located in recessed fire towers with only the balconies leading from the exits to these fire towers intercepting the building line. Separate towers to serve each of the two houses have been located on each side of the building, while all means of exit are independent for both theatres.

The architects were Mr. Thos. W. Lamb, New York, and Stanley Makepiece, Toronto (associate). The general contractors are Fleischmann Bros. Company, of New York and Toronto. The firms who supplied the various structural materials are:—facing brick, Carter, Black, Ayres Company, New York; common brick, Don Valley Brick Works; steel, Canada Foundry Company, Toronto; reinforced concrete, White Fireproofing Construction Company, Montreal; elevators, Otis-Fensom Elevator Company, Limited, Toronto; Kewanee boilers and heating, John Ritchie Heating Company, Toronto; marble, Lantz Donban Company, Toronto; interior plastering, Cathcart & Kissel, New York; interior firing and lathing, Clarence W. Noble, Toronto; plumbing, A. Walsh & Son, Toronto; electric wiring, L. K. Cumstock Company, Montreal; granite, MacIntosh Granite Company, Toronto.

Millions for Harbor Improvements

The extensive harbor improvements undertaken by the government in all parts of the country will cost, when completed, something like \$75,000,000. Every port of any importance now has under way works calculated to increase vastly the transportation facilities of the country from Halifax, N.S., to Victoria, B.C. St. John has the Courtenay Bay improvements and the dry dock, Quebec has large docks and dredging contracts, while at Levis what is said to be the biggest drydock in the world is under construction. The St. Lawrence channel is being deepened to Montreal while the port improvement scheme, when completed, will have cost eighteen million dollars. Toronto's harbor works will entail an outlay of another ten millions. At Hamilton, Sault Ste. Marie, Port Arthur and Fort William, similar undertakings will be advanced, while Winnipeg is getting navigation by the Red River. The Vancouver docks will cost upwards of \$6,000,000, while in addition to the Victoria harbor works the site is selected for a drydock to duplicate that at Quebec.

Making Asphalt Pavements Non-Slippery

The Superintendent of Street Repairs of San Francisco has hit upon a method of removing the chief objection to asphalt pavement, described in the "Municipal Record," as follows:

The method of rendering the pavement less slippery is by heating the surface of the asphalt and then applying a layer of coarse sand which is rolled into the pavement, which affords a sufficiently rough surface to enable horses to keep their footing and automobiles to pursue a straight course in wet weather. Experiments with this pavement on Fell street, between Baker and Scott, and on Scott street, between Fell and Waller, have proved so satisfactory that the city officials have decided to extend its use to other parts of the city.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

For the past year the building permits of Outremont, P.Q., totalled \$1,902,000, an increase of \$319,500. The value of the permits issued in Westmount, P.Q., was \$2,009,544.

The Highway Commissioners for Ontario will shortly submit their report to the government and legislature to enable the ministers to outline a general improvement scheme for the province.

A new building to be known as the House of Refuge (40 ft. x 100 ft., solid brick, two and a-half storeys high) will be erected during the present year in Algoma, Ont. It will accommodate fifty inmates. The architect is Mr. Thos. R. Wilks, of Sault Ste. Marie, Ont.

The Provincial Waterways Commission, presided over by Hon. S. N. Parent, have completed their report which is now before the government for consideration. It is thought likely that the commission will recommend the harnessing of the River St. Maurice near La Tuque, Que., by the building of a large concrete dam to develop over 500,000 h.p. for industrial purposes.

Arrangements for the publication of reports on the civic survey now being conducted by private enterprise in the several departments of the City Hall, Toronto, were announced recently at a meeting of the Citizens' Committee which inaugurated the scheme. It is the intention to establish in Toronto a permanent bureau in municipal research whose object will be to co-operate with the city council or prominent civic officials.

Mr. R. C. Harris, Works Commissioner, has issued his report on the necessary additions and extensions of the Toronto waterworks pumping and distributing plant. A total expenditure of \$6,677,000 is recommended, as against \$5,320,000 estimated by the special commission which reported to the city in favor of a duplicate system at Scarborough. Mr. Harris has thus disregarded the plans drawn up by the experts and their suggestion in favor of an expenditure of \$1,071,000, on the ground that the present Rosehill reservoir with its 39,000,000 gallons capacity, is sufficient. A filtration system, however, would be constructed in connection with the pumping station at Victoria Park.

A report from Ottawa states that Mr. Sanford Evans, ex Mayor of Winnipeg, will head the Commission which the government proposes to appoint to consider the economic feasibility of the Georgian Bay canal proposition. The Commission will consist of three men, one from the west, one from Montreal, and the other from Ontario. Mr. Huntly Drummond, of Montreal, has been favored by many as the Quebec representative, but a French-speaking man may be selected. Some years ago a complete survey for the projected work was made and the cost was estimated at \$100,000,000. There has since been a revision of the estimate and the figure is now placed around \$125,000,000. Reports made so far establish beyond question the practicability of the canal as an engineering work.

T. McAvity & Sons, Limited, St. John, N.B., will call for tenders early this year for the erection of the largest part of a great plant on a site comprising twenty-two acres located

beyond the Marsh Bridge. Here the firm propose to assemble their whole iron and brass manufacturing plant, and afterwards enlarge their operations until there will be a group of sixteen different buildings, and an industry affording employment to between twelve and fifteen hundred people. The contract for the whole sixteen buildings will not be awarded this year, but it is proposed to erect a very large part of the entire plant within the next two years, beginning in the present year. A spur will connect the plant with the Intercolonial Railway, and the St. John Valley Railway and Grand Trunk Pacific will also be connected when they come in to their St. John terminals at Courtenay Bay.

Advices from St. John, N.B., state that the establishment of large industries and the extension of the street railway line will result in extensive building operations in that city. It is practically certain that one or more companies will undertake the erection of groups of buildings for residential purposes, being thereby able to carry on the work of construction at less cost than in the case of small contracts. The value of building permits last year was over \$2,380,000, which was an increase of about 320 per cent. over the value for 1912. The present year may not show as great an amount, because last year's contracts included a sugar refinery, grain elevator and other large ones, but the number of individual buildings to be erected this year will be much larger than that of last year. The present indications are that while some industrial establishments will be built or enlarged, the greatest amount of attention will be devoted to providing homes, for which the demand exceeds the supply and grows greater month by month.

WESTERN CANADA

Pending the reorganization of the office the city building inspector's department of Calgary has temporarily suspended the issuance of building permits.

Mr. J. P. Jones, Dominion Government Commissioner, and Mr. Hough, Engineer, recently inspected the site for the new terminal elevator on the government land at Calgary. This section is on the main line of the C. P. R., and can easily be served by spur tracks of the C. N. R. and the Grand Trunk Pacific.

Medicine Hat erected and placed in operation ten new factories last year. These include the Medicine Hat Pottery Company's plant, the only concern of its kind in western Canada. Several hundred thousand dollars have already been spent by the Canada Cement Company on the site of their four thousand-barrel mill, a few miles west of Medicine Hat. The total expenditure in buildings for that city is expected to exceed \$2,500,000.

Official announcement is made by Hon. Robert Rogers, Minister of Public Works, Ottawa, that the government has decided to purchase the Bullen site on Lang Cove, Esquimalt, for the construction of a new \$4,000,000 dry dock, capable of handling the largest ocean liner afloat. Mr. Rogers has already given orders to prepare the plans for the undertaking, and the engineers of the department are already at work on them. The new dry dock will be 1,150 feet long, and have a 12-foot clear entrance with a 40 feet depth on the

sill at ordinary high water, and 30 feet depth at the approach.

The building permits issued at Vancouver during December amounted in value to \$175,245, and \$10,424,447 for the year 1913. The total for December, 1912, was \$1,530,365, and for the year \$19,438,432. 286 permits were issued during the year for office buildings and stores of a value of \$5,236,371; 162 permits for factories and warehouses, valued at \$2,027,278; 62 permits for apartment and rooming-houses, valued at \$1,328,834; 1,302 for dwelling-houses, costing \$1,687,447 and 215 for repairs and alterations, costing \$104,927.

Tenders have just been taken for the construction of an arts building for the University of Alberta, Edmonton, to cost about \$500,000. The building in plan will be 300 feet long by 70 feet wide, with an auditorium wing from the rear 60 feet wide and 93 ft. 4 in. deep, and will be three storeys high above the basement, with an attic storey for draughting rooms. The construction throughout will be first-class, though the building will not be entirely fireproof. The exterior will be dark red tapestry brick, with Indiana limestone trimmings. The superstructure will be partly of steel, with reinforced concrete floors in the main corridors and other public gathering points, and timber floors elsewhere. All partitions are to be of Medicine Hat terra cotta blocks.

Mr. A. W. Ellison Fawkes, water engineer, reports that the construction of a gravity pipe line to the mountains on the Elbow River together with a storage dam for the future water supply of Calgary would be the cheapest in the end. Four different estimates on the cost of constructing gravity lines to four different sites for storage dams were supplied as follows:—For the thirty-nine mile line, \$2,158,673; for the thirty-eight mile line, \$2,128,763; for the thirty-six mile line, \$1,977,322, and for the thirty-two mile line, \$1,718,343. The alternative scheme of pumping water from the Bow River, with a big filtration plant, was estimated by Mr. Fawkes to cost \$1,119,835 for the forty million gallons supplied and \$807,657 for twenty million gallons supplied. The city council is expected to spend several weeks studying the report before definite action is taken on the subject. Mr. Fawkes, who favors the gravity system, has the concurrence of Mr. G. W. Craig, formerly City Engineer of Omaha, Newbraska.

Montreal's Intake Conduit

The Montreal Council have voted \$100,000 for connecting the water conduit to the Lachine Canal, in order to obtain an emergency supply. A further like sum may be taken from the reserve fund for repairing the break in the conduit which caused the greater portion of the inhabitants to be without a regular supply for about a week. Orders have been placed for the necessary pipes to make the connection with the Lachine Canal. These will be of steel, eight feet in diameter, and 1,500 feet in length. Meanwhile the conduit is being strengthened for a considerable distance from where the break occurred, it having been decided to erect timber crib-work and fill with 5,000 cubic yards of rock, hauled by means of a temporary railway track. Mr. Freeman, the New York expert, commissioned by a body of citizens, has made one report, and Messrs. J. A. Jamieson, R. S. Lea and G. R. Heckel, the experts employed by the city, have also made an interim report, which will be followed later by an exhaustive report on the whole situation. Representatives of the principal commercial associations, including the Builders' Exchange, have asked the mayor for an independent commission of inquiry, composed of a judge of the Superior Court and two engineers of the highest standing, to investigate the break in the conduit and apportion the blame, the water department, and the scheme of water supply. The commission should be free from civic influences. The mayor has promised that an enquiry shall be held in due course, but the Board of Control will have to decide on the method.

Personal Mention

The will of the late Mr. Richard Chalkley, contractor, who died in Toronto, December 27, 1913, has been filed for probate. The estate is valued at \$80,924.

Mr. W. H. Palmer has been elected President of the Chatham Builders' Exchange. The meeting has made a recommendation in favor of the appointment of a City Building Inspector.

Messrs. J. A. Jamieson, R. S. Lea and G. R. Heckle have been retained by the Board of Commissioners of Montreal to make a report as to the cause of the recent failure of the intake conduit.

Mr. Chas. A. Millar, manager of Price's Limited, and president of the Canadian National Clay Products Association, is leaving shortly for the south where he will attend a number of United States clay-working conventions.

Mr. W. A. McLean, Provincial Engineer of Highways for Ontario, and vice-president of the Ontario Highways Commission, returned last week from Nova Scotia where he had been devoting some time to an investigation of highway conditions.

Mr. John R. Freeman, of New York, has prepared a report on the failure of the intake conduit at Montreal. The report was made at the instance of private interests who, it is understood, are endeavoring to influence important recommendations.

Mr. E. E. Brydone-Jack, M. Can. Soc. C. E., Professor of Civil Engineering in the University of Manitoba, was presented with a clock at Winnipeg on January 9 by the Manitoba Branch of the Canadian Society of Civil Engineers in recognition of his services to the Society.

Sir Percy Girouard has been elected president of the Armstrong-Whitworth of Canada, Limited, the new steel company which is constructing a big plant at Longueuil, P.Q. The other directors are: Sir George Herbert Murray, P.C., C.B., Saxton William Armstrong Noble, George Green Foster, K.C., and Matthew Joseph Butler, C.M.G.

Mr. H. G. Fulford, of Galt, Ont., and Mr. J. Evans, of Berlin, Ont., have formed a partnership as architects and their headquarters will be the former office of Mr. Evans in the Scott & Bennett block, Water Street, Galt. Mr. Fulford is a member of the Ontario Association of Architects and also of the Royal Canadian Institute. Formerly he resided in Toronto.

Mr. Carl M. Starkey, chief engineer of the H. E. Talbott Company, engineers and contractors of Dayton, Ohio, died in Montreal, of typhoid fever. He had been engaged in work at Grand Mere, Que., on the 180,000 h.p. hydro-electric power plant which the H. E. Talbott Company is constructing at that place for the Laurentide Company. Mr. Starkey had been previously engaged on the Panama Canal work.

Mr. Neil Gillies has been appointed Toronto Manager of the Master Builders Company, Toronto. Mr. Gillies first came to Toronto as manager of the Toronto business of Canada Floors, Limited. Later he formed a partnership under the firm name of Brett, Gillies and Moyes of Montreal and Toronto, carrying on an extensive business in composition and asphalt flooring. Through this connection Mr. Gillies is well-known among architects and contractors, and his appointment will enable the General Sales Manager, Mr. A. D. Dame, to devote more time to the supervision of the company's organization throughout the rest of Canada. This includes branch offices at Montreal and Winnipeg, as well as agencies in all important cities from coast to coast. We understand that Mr. Dame expects to leave for the Pacific coast in the near future.

Canadian Railroad Development

At the semi-annual meeting of the Grand Trunk Railway Company in London, Eng., Mr. A. W. Smithers, chairman of the board of directors, predicted that the last two hundred and thirty miles of road in western Canada would be completed by June next year.

Mr. Joseph Gosselin, contractor for the building of the Transcontinental Railway workshops at St. Malo, Que., is stated to be making arrangements for the employment of 1,000 men on the work. Operations will be continued actively from now until the contract is completed.

The North Railway Company have applied to the Federal Government for a subsidy for constructing the line to James Bay, a distance of 550 miles, joining up Montreal to the Transcontinental. The Government have already guaranteed the bond issue, and the company now ask for a subsidy in addition.

Plans are maturing for double-tracking the C. P. R. between Toronto and Windsor, and it is announced that the new steel will be laid as far as London before work is stopped in the fall. It is stated that important schemes for the development of Sarnia are under consideration and that options on large tracts of land have been secured.

It is expected that during the present year operations will begin on the construction of a railway across the northern part of the State of Maine connecting the existing lines at Quebec and New Brunswick, and over New Brunswick, to the Quebec border, the part for which the charter has been obtained being a distance of about 111 miles. This is likely to be an electrical road according to a statement made recently by Mr. A. R. Gould, president of the St. John Valley Railway Company.

Indicative of the fact that the Pacific Great Eastern railway intends to start a regular service north of Newport, B.C., at an early date was the announcement made on January 2 by Mr. A. H. Sperry, general manager, that an order has just been placed for 150 steel freight cars, which are to be delivered at Newport during March, April and May, 1914. The rolling stock is to be supplied by the National Steel corporation of Hamilton, Ont. Steel rails sufficient to lay 30 miles of track are now at Newport for the Pacific Great Eastern. Track has been laid 13 miles north of Newport and grading has been finished more than 150 miles from the Pacific terminals, being well advanced beyond Lillooet.

The Canadian Pacific Railway has a big programme ready for construction work in 1914, according to a despatch from Ottawa. Some of the work was started in 1913, but only the preliminaries were attended to. Among the more important works are the following: double-tracking between Sudbury and Port Arthur, between Port Arthur, Calgary and Vancouver, between Brandon and Calgary, the double track through Rogers Pass tunnel, double-tracking between Revelstoke and Vancouver, a 290-mile line between Sedgewick and Edmonton, two lines from Bassano to a connection with Swift Current. In addition to these, there are many small lines and extensions throughout the west, all of which, it is said, will cost more than \$100,000,000.

A deputation representing the North Railway Company, waited on the Government on January 8 and asked for a bond guarantee of \$35,000 per mile on the line the company is planning between the National Transcontinental Railway and the city of Montreal. Renewal of a subsidy formerly voted by Parliament for the construction of a road between Montreal and James Bay was also requested by the delegation which

was received by Rt. Hon. Mr. Borden and Cabinet members. A bond guarantee of \$35,000 per mile was asked, together with subsidies of \$6,400 per mile for the line already constructed. The company has been given land grants by the Quebec Government of about 8,000 acres per mile and 10,000 acres per mile on the proposed Montreal Transcontinental and Montreal-James Bay lines respectively. In presenting its case the delegation urged that the North Railway was in every sense a road of a national character, and therefore entitled to Government assistance. Besides connecting Montreal directly with the Transcontinental line, it will provide an alternative grain route to that of Hudson Bay by affording transportation facilities from the Nottaway River.

Convention Notes

The Toronto Branch of the Canadian Society of Civil Engineers holds its annual meeting to-day (January 21) at 8 p.m. at the headquarters of the Engineers' Club of Toronto.

The annual meeting of the American Society of Heating and Ventilating engineers opens to-day (January 21) in New York and closes on January 23. The Secretary is Mr. E. A. Scott, 29 West 39th street, New York City.

The fifth annual meeting of the American Society of Engineering Contractors was held on January 16 in the United Engineering Building, New York City. One of the features of the evening session was a lantern address on road construction given by Mr. Geo. C. Warren, president of Warren Brothers Company, Boston, Mass.

Cement users are reminded of the big events scheduled to be held in Chicago next month. The National Conference on Concrete Road-Building opens on the 12th and closes on the 14th and the American Concrete Institute is in session from February 16 to February 20. The Secretary of the Conference is Mr. J. P. Beck, 72 West Adams Street, Chicago, and the Secretary of the Institute is Mr. E. E. Krauss, Harrison Building, Philadelphia.

Mr. Jas. E. Wilson is leaving the Sewer Department of the city of Calgary to engage in the contracting business.

The Des Moines Bridge & Iron Company, of Pittsburgh, Pa., and Des Moines, Ia., have opened a contracting office at 50 Church Street, New York City, of which Mr. J. E. O'Leary, one of the company's contracting engineers, is in charge. This office will handle the business in the coast states north of Virginia and in Eastern Canada. The Des Moines Bridge & Iron Company makes a specialty of the design and construction of hemispherical bottom steel tanks on steel towers for municipal, railway and industrial work.

Obituary

Mr. George Wilson, for many years a member of the building and contracting trade, died at St. Thomas, Ont., on January 14, after a brief illness. The late Mr. Wilson, who was 60 years of age, was a native of Windham, Ont., and bore the reputation of being one of the most reliable men in the business.

Mr. George Gordon Miles, a well-known Toronto builder and contractor, died on January 12 from heart failure, said to have been brought on by excitement owing to an outbreak of fire in the vicinity of his factory in West Toronto. The late Mr. Miles, who lived at 24 Rusholme Road, was a native of Scotland where he was born in 1849. His name is connected with many of the prominent buildings erected in Toronto during the past few years, including the new wing of the western hospital, the woodwork of which he constructed, and also the new section of the Robert Simpson Company's store.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Camrose, Alta.

The by-law authorizing the expenditure of \$10,000 on street improvements having been passed by the ratepayers, the new council will take the matter up as soon as possible.

Fort William, Ont.

A by-law providing for the establishment and equipment of public playgrounds, at an estimated cost of \$10,000, was passed by the ratepayers.

Kingston, Ont.

Board of Works will shortly call for tenders on all kinds of pavement. Specifications to be provided by contractors. Six blocks are to be paved on King and Princess streets. City Engineer, R. J. McClelland.

Listowel, Ont.

The town council has decided to pave the main streets during the coming year.

London, Ont.

The city council is considering extensions to the watermains at an estimated cost of \$45,000. City engineer, W. N. Ashplant.

North Battleford, Sask.

The city council contemplates purchasing a stone crusher and a road roller.

Ottawa, Ont.

The city council contemplate lifting and relaying the wood blocks on Bank St. Bridge.

Specifications are being prepared by the Waterworks Dept. for the supply of pipes for 1914, and tenders will be called in about four weeks.

Surveys have been made by City Engineer, Arch. Currie, for the following asphalt pavement: on Munro St., between Bell and Division Sts. Estimated cost \$8,000; on Percy St., between Gladstone and St. Catherine Sts., estimated cost \$10,000; and on Hinton St., between Wellington and Armstrong Sts., estimated cost \$5,000. Plans have been drawn for asphalt pavement on Arlington St., between Bronson and Bell Sts., estimated cost \$8,000, and the council has been petitioned for asphalt pavement on Second Ave., between Lyon and Percy Sts., estimated cost \$10,000. In addition to this surveys have been made for macadam roadway, with tarvia finish, on Cambridge St., between Somerset and Primrose Sts., estimated cost \$5,000, and on Lyon St., between Carling and Powell Sts.

Regina, Sask.

The city council has under consideration the construction of 15 miles of water mains, and the installation of 1,500 meters, work on which will be started this

year. Engineer, J. M. MacKay, Waterworks Dept.

Sudbury, Ont.

The town council is considering an extension of the trunk sewer. Engineer, M. Tessier.

Toronto, Ont.

The Commissioner of Works, R. C. Harris, recommends that tile pipe sewers be laid on 19 lanes at a cost of \$27,640.

The Commr. of Works, R. C. Harris recommends the laying of 28 ft. pavement on 5 in. concrete foundation, with concrete gutters on Braemore Gardens, estimated cost \$10,570, and 24-ft. pavement on Silver Birch Ave., estimated cost \$9,427.

The Commissioner of Works, R. C. Harris, recommends the laying of 28 ft. to 36 ft. pavement on 5-in. concrete foundation, concrete gutters on Neville Park Blvd. at estimated cost of \$8,885, and 28 ft. pavement, 5-in. concrete foundation, combined, concrete curbs and gutters on Ashdale Ave. at estimated cost of \$15,132.

Tenders addressed to Chairman, Board of Control, will be received until Feb. 3rd for sewers, West Toronto Division No. 2, outlet Ossington Ave. and Hal-lam St. Storm Overflow sewer. Plans, etc., at office of Works Department.

The Board of Control has extended the time to Jan. 30th for tenders on complete mechanical filtration plant, boilers, steam turbo. Generator plant and appurtenances for Toronto Island.

The Commr. of Works, R. C. Harris, has recommended tile pipe sewer on lane from Manning to Clinton, 1st north of College, \$820; and on Walmsley Blvd. from Baker to Lawton, \$1,280.

Walkerton, Ont.

The town council is considering the laying of pavements in various parts of the town. Mayor, F. W. Lippert.

Windsor, Ont.

The City Council are considering the laying of a concrete sewer pipe on Marion street, at an estimated cost of \$6,000. City Engineer, Ed. Brian.

CONTRACTS AWARDED

Toronto, Ont.

A contract has been awarded by the Board of Control to general contractor, A. P. Smith Mfg. Co., East Orange, N.J., for the supplying of 24 6-in. sleeves and valves, and 36 6-in. sleeves and valves at \$1,570.80. For Water Works section at Soho St.

Vancouver, B.C.

The city council has awarded paving contracts as follows: H. J. Kaiser, 1601 Comox St., Victoria Drive at \$133,922; Columbia Bitulithic, Ltd., 402 Pender St.

W., South Cambie at \$42,427, Commercial Drive at \$20,385, Fir St., at \$7,317, Cornwall St., \$18,894, 11th Ave., at \$4,744. Other contracts will be awarded later. Engineer, F. L. Fellowes.

Railroads, Bridges and Wharves

Calgary, Alta.

The G. T. P. Rly. has purchased a site for the erection of a station here. Chief Engineer, B. B. Kelliher, Winnipeg.

Courtright, Ont.

The Lambton County Council has appointed a committee to interview the Dom. Govt. with reference to the building of a seawall along Twps. of Moore and Sombra. A report will be made to the council Jan. 27th.

Freeport, N.S.

Tenders for breakwater addressed to Sec., R. C. Desrochers, Public Works Department, Ottawa, will be received until February 9th. Plans, etc., at office of Dist. Engineers, Halifax and Antigonish, Postmaster, Freeport and at Dept., Ottawa.

New Westminster, B.C.

The Great Northern Railway Co. have under consideration the reconstruction of the Ferry St. slip to accommodate a new 3-track ferry. Slip to be 400 ft. long.

The New Westminster Southern Rly. Co., have had plans drawn for a bridge to be constructed over the Nicomekl River in Dist. of New Westminster.

Ottawa, Ont.

The matter of the temporary bridge on Bank St. is held up until a settlement is made with regard to price.

Owen Sound, Ont.

The Grand Trunk Rly. has under consideration the construction of a vitrified brick construction station. Full information can be obtained from Supt Chas. F. Forrester, Stratford.

The town council has had surveys made for laying a railway line from Sound to Meaford, the distance being about 30 miles.

The Bruce Peninsula Railway Co. will apply to Parliament for power to operate and construct a line from Wiarton to Tobermory. Company's solicitor, E. C. Spereman, Owen Sound.

Sarnia, Ont.

The Street Rly. Co. will probably extend their line south along river bank.

Thedford, Ont.

The G. T. Rly. Co. has under consideration the erection of white brick construction station at this point.

Toronto, Ont.

Alderman A. E. Walton has brought before the council the question of the construction of a new bridge on Main St., East Toronto, over G. T. R. tracks, also the widening of Main St. from Gerard to Danforth Ave.

Public Buildings, Churches, Schools, etc.

Belleville, Ont.

Tenders for interior fittings, post office, addressed to Sec., R. C. Desrochers, Public Works Department, Ottawa, will be received until Jan. 28th. Plans at the office of Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto; with Caretaker, Public Bldg., Belleville; and at Dept., Ottawa.

Bond Head, Ont.

Tenders addressed to J. P. Wilcox, Rural Route No. 1, Beeton, Ont., will be received until Feb. 10th for the erection of a church for the Methodist Church Congregation. Plans, etc., at office of M. B. Hipwell, Bond Head.

Brockville, Ont.

Tenders addressed to Sec. Public Works Dept., H. F. McNaughten, Toronto, will be received until Jan. 28th for steam heating, plumbing and wiring at Reception Hospital Asylum for Insane. Plans at Dept. and Hospital.

Calgary, Alta.

The city council has purchased a site for stock yards, and work will be started as soon as arrangements are completed with railway companies interested.

The work on the examining warehouse planned by the Public Works Dept. has been postponed until spring.

Fort Francis, Ont.

Tenders addressed to Sec. Public Works Dept., H. F. McNaughten, Toronto, will be received until Jan. 28th, for steam heating, plumbing and wiring, at the Court House. Plans at Dept. and office of Sheriff.

Guelph, Ont.

Tenders addressed to Sec. Public Works Dept., H. F. McNaughten, Toronto, will be received until Jan. 28th for electric wiring for dining hall at Agricultural College. Plans at Dept. of College.

The General Committee of the Y. W. C. A. has secured options on property suitable for the erection of a suitable building.

Haileybury, Ont.

Tenders addressed to Sec. Public Works Dept., H. F. McNaughten, Toronto, will be received until Jan. 28th for steam heating, plumbing and wiring at the Court House. Plans at Dept. and office of Sheriff.

Hamilton, Ont.

The congregation of the Gospel Tabernacle, Pastor, Rev., P. W. Philpott, have plans under consideration whereby lecture hall will be enlarged for Sunday school purposes.

Kelowna, B.C.

The Dept. of Militia & Defence have under consideration the erection of a drill hall here. Sec., E. F. Jarvis, Ottawa.

Lindsay, Ont.

Tenders are to be called shortly by the Board of Education, for the erection of a school building at an estimated cost of \$7,000. Chairman Bldg. Com., J. W. Anderson.

London, Ont.

Improvements to the hospital for the Insane are contemplated by the Public Works Dept., Sec., H. F. McNaughten, Parliament Bldgs., Toronto.

The Board of Education contemplates the erection of a school building on Grand Ave; on Riverview Ave.; on Princess St.; and one in the north-eastern part of the city.

The Public Works Dept. has under consideration additions to the post office, the estimated cost of which is \$400,000.

The Dept. of Militia & Defence has under consideration additions to the armouries at an estimated cost of \$50,000. Sec., E. F. Jarvis, Ottawa.

Melville, Sask.

The Separate School Board is considering the erection of a school building at an estimated cost of \$20,000. Sec., J. Salmon.

Montreal, Que., Longue Pointe

Tenders are about to be called by Sec., L. N. Senecal, Board of Commrs., for the erection of a fire station at an estimated cost of \$50,000. Architects, Venne & Labelle, 5 Beaver Hall Sq.

Ottawa, Ont.

A Sunday School building with gymnasium and reading rooms will probably be erected by the congregation of Daly Ave. St. Pauls Presbyterian Church. Financial Secretary, G. A. Lindsay, 217 Laurier E.

The Public Works Dept. has under consideration an addition to the south wing of the Metcalfe Street Library.

Special Committee of Knox Presbyterian Church will be appointed to take charge of arrangements, receive plans, etc., for the renovation of the church. Treas., B. M. Northrop, 8 Regent St.

The Royal Society of Canada has petitioned Government for a new building. Hon. Sec., Duncan C. Scott, 108 Lisgar St.

Regina, Sask.

The city council contemplate the erection of a fire hall at an estimated cost of \$20,000. Work will probably start in spring.

Sydney, C. B.

The School Board has decided to erect a school building at Westmount, which is to be completed by Sept. 1st. Architect is not yet appointed. Trustees, H. C. Harrington, Malcolm McMillan and Alex. McLennan, all of Westmount, near Sydney.

St. Felix de Valois, Que.

Plans are in progress for a presbytery for St. Felix de Valois Congregation, and G. A. Monette, 260 St. James St., Montreal, architect, will call tenders for general contractor about March 1st. The estimated cost is \$25,000.

St. Thomas Ont.

The following additional contracts have been awarded in connection with the Y.

M. C. A. building on Talbot St. General contractor, A. E. Ponsford; heating and plumbing, Hamilton & Stott, \$10,041.25; electrical, C. W. Howkins, 283 Talbot St., \$1,758. The general contract includes masonry, carpentry, structural steel and ornamental work, plastering, painting and metal work, marble, cut stone and roofing. Contracts for hardware and electric fixtures estimated at about \$2,000, is still to let.

Tillsonburg, Ont.

Tenders will be received by Architect, W. A. Mahoney, Guelph, on behalf of the Library Board of the Town Council for the construction of the Carnegie Free Library.

Toronto, Ont.

The Library Board has asked Board of Control to provide for a library site in the widening of Yonge Street at Deer Park.

The Board of Control has decided to recommend the construction of a police station in Ramsden Park instead of at Davenport and New Street.

Plans are being prepared by Architect, A. W. Holmes, 10 Bloor St. E., for the erection of the Church of the Holy Name, at the corner of Carlaw and Fulton Sts.

Plans are being prepared for additions to Danforth Ave. Methodist Sunday School whereby an additional capacity of 700 will be given. Further particulars can be obtained from W. W. Hiltz, 682 Broadview Ave.

Tenders to be called shortly by Architect, C. J. Read, 204 Confed. Life Bldg., for the erection of a club house for St. Pauls Athletic Club, Queen St. E. The estimated cost is \$60,000.

Vancouver, B.C.

It is probable that the Municipal Council will call for competitive plans for the new city hall which it is proposed to build on the Central School site.

South Vancouver, B.C.

The Municipal Council has provided \$17,000 for purchasing a site for a new fire hall.

Vernon, B.C.

The School Board has purchased sites, and plans have been prepared for the erection of two schools at an estimated cost of \$35,000 each. A by-law will be submitted to ratepayers for the necessary authority.

Warner, Alta.

The Municipal Council is considering the erection of a town hall at an estimated cost of \$10,000. Clerk, G. W. Morton.

Yorkton, Sask.

The Public Works Dept. contemplate additions to the Land Titles office at an estimated cost of \$15,000. Deputy Minister, E. Brown, Regina.

The Govt. has voted the sum of \$40,000 for the erection of Court House.

CONTRACTS AWARDED

Hamilton, Ont.

The following contracts for alterations and addition to Hunter St. school have been awarded by the Board of Education. Mason, Geo. E. Mills. Carpenter, Bremner & Penny. Roofing and blackboards (8), J. E. Riddle & Son. Plas-

tering, Hannaford Bros. Painting, J. Boyd & Son. Heating and plumbing, A. Clark. Architects, Stewart & Witton, H. P. & L. Bldg. Total cost \$16,832.

Oxford Centre, Ont.

Contracts for a school building have been awarded by the School Board to Mason, Geo. Selzer, Tavistock; carpentry, Kalfleisch & Apple, Tavistock; painting, Mr. Schlit, Tavistock; heating, Geo. Eifert, Tavistock. Architect J. S. Russell, 21 Downie St., Stratford.

Toronto, Ont.

A contract for repairs to Simpson Ave. Methodist Church Sunday School, recently damaged by fire, has been awarded to Skipper Bros., 339 Curzon Ave., for carpentry. Plastering, painting, plumbing, wiring, etc., will be let as work progresses.

Business Buildings and Industrial Plants

Assiniboia, Sask.

Tenders will be received by Hub Clothing Co., Weyburn, for the erection of a store, estimated cost \$6,000.

Aylmer, Que.

C. P. Meredith, architect, 126 Sparks St., has plans in progress for the Silver Springs Dairy Farms, Ltd., for the construction of cow barns, dairy produce buildings, offices, etc.

Upper Bedford, Que.

The Corey Needle Co. are considering certain additions to their plant.

Bobcaygeon, Ont.

E. Woollard contemplates the erection of a drug store.

Coquitlam, B.C.

W. C. Bond, 304 Pemberton Bldg., Victoria, will start work shortly on proposed brass foundry provided water and electric power facilities are given.

Hamilton, Ont.

Molson's Bank contemplate the erection of a branch office at the corner of Barton and Ottawa Sts., and at the corner of James and Barton Sts. Manager, W. S. Connelly, 28 James St. S.

The Tallman Brass Co., Wilson & Sanford Ave., propose to make certain additions to their factory at a cost of about \$15,000. Architects, Stewart & Witton, 7 Hughson St. S.

Kaslo, B.C.

The Kootenay Mills, Ltd., are considering the rebuilding of their mill and sash and door factory. Work is to start about the end of January, and modern machinery will be installed. Sec., R. H. Fulton, Walter Scott Bldg., Moose Jaw.

Lindsay, Ont.

The town council propose acquiring a building which will be adapted for the purposes of a club house.

Horne Bros., William St., will ask the town for exemptions to aid in making improvements to their woollen mills.

Montreal, Que.

Belding Paul Corticelli Ltd. has under consideration the erection of an office building on Shearer St.

White Constrution & Realty, Limited, Coronation Bldg., who has the contract for the Peerless Theatre, 269 Bleury St., has let the contract for electric fittings to Stanley B. Chauvin.

Tenders are being received by Imperial Oil Co. for altering one floor of factory into office. Contract to be awarded immediately. Estimated cost \$5,000.

Tenders have been received for stores, etc., on St. Catherine W., for Dominion Sq. Land Co., St. Catherine and Metcalf Sts. Contracts are not yet awarded. Architects, Brown & Vallance, Can. Life Bldg.

Ottawa, Ont.

H. Taylor, of Hotel Cecil, 224 Sparks St., is considering certain alterations and improvements to his premises.

J. C. Macdonald, Albert St., has purchased a site for the erection of a large store and apartment block. Estimated cost is \$80,000.

Peterboro, Ont.

Tenders will be received by Geo. M. Miller & Son, 93 Yonge St., Toronto, architect, for general alterations and additions to the National Hotel. Plans at office of hotel and architect.

Port Arthur, Ont.

The recently organized Bertrand-Lockhart Lumber Co., has under consideration the erection of a planing mill, etc., on Hester and Ontario Sts.

Regina, Sask.

The city council is considering the erection of a stone foundation, brick construction garage, as an estimated cost of \$7,500. Building Inspector, O. W. Falls.

Sauble Falls, Ont.

M. D. Seaman & Son will shortly close their saw mill, and will erect a plant for the manufacture of sand lime brick.

Stratford, Ont.

Plans have been drawn by Thos. Hepburn, architect, Downie St., for addition to the factory of the Avon Hosiery Co., Erie St. Estimated cost \$10,000.

Sudbury, Ont.

A. Silverman, Elm St., contemplates the erection of a business block on Durham St. Estimated cost \$30,000.

J. Mackay is interested in the proposed erection of a business block and dance hall on Durham St. at an estimated cost of \$40,000.

Sketches are to be prepared by Wm. H. Owens, architect, for alterations and addition to The American Hotel at an estimated cost of \$25,000.

Sydney, N.S.

The old premises of H. C. Ballem & Co., 370 Esplanade, are to be razed about April 1st, and plans are being drawn for the erection of a new two-storey wharf and warehouse. Estimated cost \$5,000.

Ste. Agathe Des Monts, Que.

The St. Agathe Lumber & Constr. Co., Ltd., recently incorporated with capital of \$300,000, will probably erect a factory for the manufacture of cement products, in addition to their sash and door factory now under construction.

St. John, N.B.

A site at Coldbrook has been leased by the Dom. Motor Car Co., Ltd., and a brick manufacturing plant will be erected thereon.

St. Thomas, Ont.

J. T. Findlay, having drawn plans for addition to Star Theatre, will call tenders in about two weeks.

Tenders will be received by J. T. Findlay, architect, immediately, for the erection of offices for the Merchants Bank.

Toronto, Ont.

Plans for theatre alterations at an estimated cost of \$8,000, have been drawn for Wm. Stephany, 235 Carlton St., by A. E. Packer, architect, who is about ready to call for tenders.

Windsor, Ont.

Meretsky & Gitlin are contemplating alterations to their stores on Pitt E., at an estimated cost of \$5,000.

A store and flat will probably be erected on Market Sq. by Aaron Meretsky.

Winnipeg, Man.

The erection of stores on Main St. at a cost of \$10,000 is contemplated by a client of Oldfield, Kirby & Gardiner, Ltd., Portage Ave.

CONTRACTS AWARDED

Hamilton, Ont.

A contract for additions to their factory on Lottridge St. has been awarded by F. W. Bird & Son to J. Poag & Co., Westinghouse Ave. Machinery to the value of \$10,000 will be installed.

Lindsay, Ont.

The contract for store and 8 residences has been awarded by John Maunder, Jr., to M. H. McGeough.

Toronto, Ont.

A contract for additions and alterations to office and factory has been awarded by Chas Wilson, Ltd., 519 Sherbourne St., to W. H. Joselin & Son, 442 Ontario St., \$6,900.

Residences

RESIDENCES ... fY..

Copper Cliff, Ont.

The Canadian Copper Co. intends erecting 16 residences at No. 3 Frude Mine in spring, at a cost of \$2,500 each.

Galt, Ont.

Adam Unger, 71 Rose St., has purchased a site and will have plans prepared for a new residence.

Montreal, Que.

Plans are in progress and R. Garipey, architect, will call tenders in about a month for the erection of an apartment block for L. Belanger, 30 St. James.

A permit has been issued to Messrs. Lecaveleir & Chasse, 65 Cherrier St., for the erection of six flats on Ed. Charles St., at an estimated cost of \$15,000.

E. & W. S. Maxwell, 6 Beaver Hall Sq., have plans in process for alterations to the residence of E. Maxwell, and will call for tenders shortly.

Montreal, Que., St. Lambert

Plans are in progress for a residence for Mr. C. O. Darier. G. A. Monette, architect, 260 St. James St., Montreal,

will call for sub-contracts about Feb. 1st. Estimated cost \$25,000.

Ottawa, Ont.

A. Brahansky, 293 Mundy St., contemplates the erection of a residence on St. Andrew St., at an estimated cost of \$7,000.

Regina, Sask.

S. K. Powell, 1333 15th Ave., contemplates the erection, at an estimated cost of \$35,000, of a 3-storey apartment block containing 12 suites.

A. W. McGregor, 8 Masonic Temple, is considering the erection of a 3-storey, 50 x 80, reinforced concrete, fireproof and brick construction apartment block, containing 12 suites; the estimated cost is \$45,000.

Ridgetown, Ont.

The Presbyterian Church Congregation are considering the erection of a manse for their pastor, Rev. M. J. McPherson.

Stratford, Ont.

H. W. Strudley has under consideration the erection of 10 residences, at an estimated cost of \$15,000. The architect is not yet chosen.

Sudbury, Ont.

Wm. H. Owens, architect, has sketches in progress for a residence for Dr. W. C. Morrison, to be erected near College St., at an estimated cost of \$7,500.

Toronto, Ont.

Samuel Young, Jr., 69 Hazelton Ave., has purchased a 50 x 100 site on High Park Blvd., and will erect a \$10,000 house in the spring.

Plans have been drawn for one pair stores and residences on Leslie St., for P. H. Lambert, 97 Ann St., at an estimated cost of \$5,000.

Plans have been drawn for 2 detached residences on Hilton Ave., for A. A. Hobson, 70 Hilton Ave., who will superintend construction, and will sublet some trades. Estimated cost \$7,000.

Plans have been drawn for a detached residence, on Spadina Road, for A. E. Armstrong, 61 Farnham Avenue. Estimated cost \$5,000.

Recent building permits for residences include:

H. Simpson (in trust), four 2-storey brick dwellings on King St. W. \$12,000.

J. E. Peterkin, 3 pair semi-detached 2-storey brick dwellings near Fairmount Cres., on east side Bowmore road, \$12,000.

Alder & Ziscroft, four 3-storey attached stores and dwellings, near Dufferin St. on south side Dundas St., \$20,000.

M. A. Henderson, 2 pair 2-storey brick dwellings, near Spring Grove, on Hounslo Heath, \$7,000.

E. Gagnor, one pair 2-storey brick dwellings, near Kingswood, on north side Queen, \$5,000.

J. G. McConkey, 2 pair 2-storey brick dwellings, on north-west corner Beaver and Lightbourne Sts., \$8,000.

Robt. M. Mackey, 6 pair 2-storey brick dwellings, on Laughton Ave., \$20,400.

P. W. Ellis, 2½-storey brick dwelling, near Park and Lonsdale, on corner of

Oriole Road, \$10,000, and 2½-storey brick dwelling, on Parkway and Oriole, \$10,000.

Dr. Dunlop, 1 pair 2½-storey, brick dwelling, near Yonge, on Joseph Ave., \$5,000.

Cromer and Hamm, 1 pair 2½-storey brick dwelling, on 96-98 Gothic Ave., \$5,000.

Robt. Doherty, 2½-storey brick dwelling, on 56 St. Andrews Gardens, \$5,500.

M. Goodheim, 3-storey and basement apartment house, on 1046-8 Dundas, \$15,000.

S. Robertson, 1 pair 2½-storey brick dwelling, on 112-114 Fulton Ave., \$5,000.

Toronto Housing Co., 31 attached and 6 pair 2½-storey brick dwellings, near Logan, on south side Bain Ave., \$64,500.

Donnefield Bros., 3 pair 2-storey brick dwelling, near Kingston Road, on Willow Ave., \$10,000.

C. W. Defoe, 2½-storey brick dwelling, on 162 Glen Road, \$12,500.

John V. Gray, 2 pair semi-detached 2-storey brick dwellings, corner Mountjoy and Bathgate, \$8,000.

McCabe & McIlroy, 1 pair 2-storey brick dwelling, on 91 Clara Ave., \$5,800.

W. H. Mallory (in trust), 1 pair semi-detached 2½-storey brick dwelling, near Gerrard, on Edyth, \$5,000.

G. Coates, 1 pair and 1 detached 2-sty. brick dwellings, on south-east corner Myrtle and Curzon, \$6,000.

N. G. Beggs (in trust), 7-storey rooming house, steel, terra-cotta and brick, at north-west corner Isabella and Sherbourne, \$45,000.

Toronto, Ont., Port Credit

J. A. Thatcher, architect in trust, 31 Queen W., Toronto, is open to receive tenders for a 2½-storey \$9,000 residence.

Vancouver, B.C.

J. N. Semmens, architect, 9 McArthur Bldg., Winnipeg, has plans in progress for a residence for E. H. Neville, Standard Land Co., Winnipeg. Estimated cost \$12,000 to \$15,000.

Winnipeg, Man.

The Williamson Realty Co., 409 Somerset Blk., has under consideration the erection of a large number of dwellings during this year in various parts of the city.

CONTRACTS AWARDED

Blenheim, Ont.

The following contract has been awarded in connection with the erection of 8 residences for F. Phillips. Lumber, T. C. Warwick, 80,000 feet.

Lindsay, Ont.

The contract for the erection of the residence for W. G. Dunoon (druggist), Kent St., has been awarded to M. H. McGeough, Simcoe St.

Toronto, Ont.

Additional contracts for the residence of F. Mowat, Warren Rd., have been awarded as follows. Heating and plumbing, Maxwell & Johnson; painting, Palmer and Elliott; plastering, Hanna & Nelson. Architect, W. A. Langton, 38 North St.

A contract for alterations to residence

has been awarded by E. Puddy, 656 Lansdowne Ave., to R. Turnbull, 13 Sword St.

Power Plants, Electricity and Telephones

Toronto, Ont.

The Water, Power & Light Commission of Weston has decided to install an auxiliary steam plant to prevent water famine.

Winnipeg, Man.

Tenders addressed to M. Peterson, Sec. Board of Control, will be received until Jan. 21st for the construction of towers on the new transmission line between Winnipeg and Point du Bois, estimated cost \$50,000.

Wyoming, Ont.

The town council requires a new dynamo and additional electric lighting equipment. Full information from H. G. Taylor, clerk.

CONTRACTS AWARDED

Brockville, Ont.

The town council has awarded to Turbine Equipment Co., Ltd., the contract for the supply of two 3,000,000 gal. De Laval centrifugal pumps.

Montreal, Que.

The Board of Commrs. has awarded to McDonald & Wilson, 99 Drummond St. the contract for the electric light fixtures for city hall annex at \$8,650.

Toronto, Ont.

The Board of Control has awarded to Mussen's Ltd., 155 Richmond St. W., the contract for the supply of one No. 4 eccentric bushing; one No. 24 main frame; one No. 38 main shaft; one No. 32 main shaft key, at \$732.50. To be used at Princess St. crushing plant.

Miscellaneous

Assiniboia, Man.

Tenders addressed to Sec.-Treas. Rural Municipality of Assiniboia will be received until 4 p.m. Jan. 20th for supply of lumber for 1914. Further particulars from Sec.-Treas.

Bathurst Village, N.B.

The Bathurst Lumber Co., Ltd., is fitting up a saw and shingle mill to be in operation May 1st, for which shingle machines, band saw, band resaw will be required.

Calgary, Alta.

Tenders addressed to Sec., R. C. Desrochers, Public Works Dept., Ottawa, will be received until Feb. 11th for 3 standard passenger elevators and one freight elevator, complete with motor generator sets. Plans at office of Leo Dowler, Res. Architect, Calgary, H. E. Matthews, Res. Architect, Winnipeg, and at Dept., Ottawa.

Chatham, Ont.

Board of Education are considering the purchase of manual training equipment. Chairman, Dr. T. L. McRitchie.

Fredericton, N.B.

The Fire Chief recommends placing an order at once for combination chemical and hose wagon.

Halifax, N.S.

Tenders addressed to G. J. Desbarats, Dept. of the Naval Service, Ottawa, will be received until noon Jan. 30th for one marine type cylindrical boiler, 6 ft. diameter x 6 ft. 7 in. long, fitted with one corrugated suspension furnace, for the Cadets Instructional workshop at H. M. C. dockyard, Halifax. Specifications at the office of the Dept.

Montreal, Que.

Tenders addressed to M. P. Fennell, Jr., Asst. Sec. Harbour Commrs., will be received until 12 o'clock noon Jan. 22nd for the following: timber, sand, Portland cement, castings, steel rails and angle bars, steel bars, paving blocks. Specifications at office of Chief Engineer.

Ottawa, Ont.

Specifications for special castings are being prepared by the waterworks department, and tenders will be called shortly.

Specifications are being prepared by the waterworks department for the supply of asphalt for 1914 and tenders will be called shortly.

The Public Works Department is still considering purchase of dredge for the St. Lawrence River traffic.

Quebec, Que.

The City Council has awarded the contract to Steel Co. of Canada, Ltd., for the supply of 20 miles copper wire, 350 lbs., to the mile; 2 small alarm gongs of 5-in. diam., 2 alarm gongs 14 in. diam.

Sarnia, Ont.

The purchase of fire apparatus is under consideration by the Town Council.

Sudbury, Ont.

Tenders will be received by Rothchilds Bros. for removal of burnt buildings on Elgin Street, to make room for new structure.

Tenders will be received by the Town Council Clerk until January 26th for the supply of 200 35-ft. cedar poles.

Toronto, Ont.

The Property Commissioner, J. Chisholm, has placed \$11,000 in his estimates for the installation of a sprinkler system at the City Hall.

The Toronto Housing Co., Ltd., Continental Life Bldg., will receive tenders for 2,000,000 bricks, one half of which are to be face bricks. Full information from Sec.

Winnipeg, Man.

The Board of Control has awarded the contract to Canadian Motor Co., Ltd., Portage Ave. E., for 3½ ton "Detroit Electric" Truck at \$6,543.

A contract has been awarded by the Board of Control to W. J. Holmes, Langside and Portage Ave., for ice breaker and fender for Louise bridge at \$13,960.

CONTRACTS AWARDED**Ottawa, Ont.**

The Dept. of Marine and Fisheries has awarded to Polson Iron Works, Toronto, Ont., the contract for the supply of 1 buoy steamer, \$175,000; 2 lightering vessels, \$99,000. The lightering vessels are to be used in connection with operations at Port Nelson.

Quebec, Que.

The Quebec Harbour Commission has awarded to Polson Iron Works, Toronto, Ont., the contract for the supply of 6 dump scows, \$130,000.

Toronto, Ont.

Contracts for piping and castings have been awarded by the Board of Control to Can. Allis-Chalmers Co., King and Simcoe St., for piping, \$910; Lumen Bearing Co., Weston Rd., for four castings, at \$400. To be used at high level pumping station.

Business Notes**Acton, Ont.**

The residence of Wm. Beardmore has been destroyed by fire.

Baynes Lake, B.C.

The general store of Dunn Bros. has been destroyed by fire; a new store of concrete construction will be built at once.

Belleville, Ont.

The office building of the Schuster Coal Co., Ltd., has been destroyed by fire.

Caledonia, Ont.

The plant of the Laurentia Milk Co., Ltd., has been destroyed by fire, the loss is estimated at \$20,000, partly covered by insurance.

Hamilton, Ont.

The machine shop of Canada Crushed Stone Co. has been damaged by fire to the extent of about \$20,000; partly covered by insurance.

Listowel, Ont.

The Grand Central Hotel stables, having an accommodation for 300 horses, has been destroyed by fire. A fire also occurred at the town hall, when all the fire fighting apparatus stored in the building was destroyed.

Midland, Ont.

The Ingram & McLeod Blocks have been destroyed by fire; the loss is estimated at \$70,000.

Montreal, Que.

Park Concrete Block Co., has been registered with P. C. Walsh, J. Hughes and M. T. Lovett as partners.

The firm of Simpson & Benoit, contractors and brick layers, has been dissolved.

The Universal Builders and Contractors Company has been registered.

The firm of Quinlan and Robertson, Ltd., contractors, has been registered.

The warehouse of Frothingham & Workman, hardware dealers, has been destroyed by fire. Loss about \$250,000.

The warehouse of the Robinson-Oliver Grain Co., 2741 Park Ave., has been destroyed by fire; loss \$50,000.

The flats on St. Hubert owned by E. Hurtubise, 1700 Christopher Columbus, have been damaged by fire to the extent of about \$25,000.

The stables of Alderic Lefebvre, 26 Victoria Sq., have been destroyed by fire; estimated loss \$20,000.

The sawmill of W. Bleu, St. Zotique and Des Ecord streets, has been dam-

aged by fire to the extent of about \$15,000.

A fire involving a loss of \$15,000 has occurred at the factory of the Canadian Tube & Iron Co., Victoria St., Ville Emard.

The flats owned by Mr. C. Courtois, 832 Outremont Ave., have been damaged by fire to the extent of \$20,000.

Ottawa, Ont.

The residence of Percy A. Taverner, 45 Leonard Ave., has been completely destroyed by fire, the loss is fully covered by insurance.

Quebec, Que.

The sawmill and furniture factory of Valliere Furniture Co., cor. St. Roch and Valliere streets, were destroyed by fire. Damage estimated at \$100,000.

Sarnia, Ont.

The store of Smith & Ash has been destroyed by fire. Loss \$40,000. Insurance \$31,000.

Toronto, Ont.

The factory occupied by Toronto Woodworking Co., Parker Bros. (Woodworking Co.), and J. W. Woolnough (Show cases), has been destroyed by fire. Loss \$80,000; insurance about \$50,000.

Winnipeg, Man.

The Iroquois Hotel has been damaged by fire to the extent of about \$14,000, which is covered by insurance.

New Companies

Fauteux, Limitee, Verdun, Que., incorporated, capital \$99,900, to carry on business as hardware merchants, lumber merchants and general contractors. Incorporators J. O. Fauteux, hardware merchant; E. Fauteux, clerk; H. Fauteux, builder, of Verdun, Que., and A. Fauteux, Montreal.

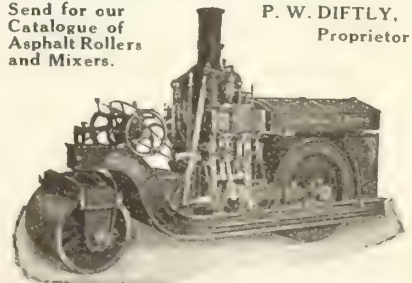
Modern Foundry and Soil Pipe Co., Ltd., Cap de la Magdeleine, Que., incorporated, capital \$250,000. Incorporators, L. A. Payette, manufacturers' agent; J. Galipeau, engineer; J. T. Surprenant, T. B. de Grosbois, accountant, and Z. O. Tourangeau, merchant, all of Montreal.

Northern Electric Co., Ltd., Montreal, incorporated, capital \$10,000,000. Incorporators, H. F. Sare, secretary; G. R. Gray, engineer; G. A. Moore and J. R. L. Collins, all of Montreal.

ERIE MACHINE SHOPS

Send for our
Catalogue of
Asphalt Rollers
and Mixers.

P. W. DIFTLY,
Proprietor



"Our 20th Century Roller"
1303 Peach Street, - Erie, Pa.

Tenders and For Sale Department

WANTED

A small second-hand Air Compressor for use in driving wood drill.

Cadwell Sand & Gravel Company, Ltd.,
3 Windsor, Ont.

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent., an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929, Contract Record, Toronto. 53-12

Tenders Wanted

Sealed tenders will be received until the 3rd of February, 1914, for the building of Church and sheds on the site of the present Melville Church, Brussels, also tenders for sale of old church.

Tenders to be addressed to M. Black, Brussels, Secretary of Building Commission.

Revised plans and specifications can be seen at Fox's Drug Store after January 22nd.

The lowest or any tender not necessarily accepted. Separate tenders required for the various departments of the work on church and sheds.

J. LECKIE, Chairman.

M. BLACK, Secretary.



Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, February 3rd, 1914, for the construction of the following sewers, viz.:

Coxwell Ave., from Gerrard St. East to Danforth Ave.

Christie Street, storm overflow sewer, Barton Ave. to C. P. R.

West Toronto, Division No. 2, outlet from Annette St. and Western Ave. to Pelham Ave. and Laughton Ave., via Western Ave., Dundas St., Wilkinson Ave., G. T. R. and C. P. R. right-of-way, Osler St. and Pelham Ave.

Ossington Ave. and Hallam St., storm overflow sewer, from Ossington Ave. and Manchester Ave. to Hallam St. and Dovercourt Rd., via Ossington Ave. and Hallam Street.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender the names of two sureties, approved of by the City Treasurer, or in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid. Conditions relating to tendering as prescribed by city by-law must be strictly complied with. The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, January 14th, 1914.



To Contractors

Sealed tenders marked "Tender for Plumbing, Etc.," addressed to the undersigned, will be received at this Department up to noon on Wednesday, the 28th day of January, for the Steam Heating, Plumbing and Electric Wiring required in the following buildings: The Reception Hospital, Asylum for Insane, Brockville; The Court House at Fort Frances, and Court House, Haileybury, and for Electric Wiring only of Dining Hall, Ontario Agricultural College, Guelph. Plans and specifications can be seen at this Department, at the above Institutions, Brockville and Guelph, and at the Sheriff's Office in Fort Frances and Haileybury.

An accepted bank cheque, payable to the Honorable J. O. Reaume, Minister of Public Works, for five per cent. of the amount of the tender and the bona fide signatures and addresses of two sureties or the name of a Guarantee Company approved by this Department, willing to provide bond for the due fulfilment of the contract, must accompany each tender. The Department is not bound to accept the lowest or any tender.

By order,

H. F. McNAUGHTEN,

Secretary, Public Works Dept., Ontario.

Department of Public Works, Ontario,
Toronto, January 15th, 1914.

Newspapers publishing this without authority will not be paid for it.

Good Opportunity to Importers of Waste and Steels

Firms interested in above write

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Limited
803 McGill Building, Montreal 2-3-4

Wanted Employees

WANTED—First-class Architectural Draughtsman. Permanent situation if satisfactory. State terms and experience. Box 937 Contract Record, Toronto. 2-3

Late News

Annapolis, N.S.

The town council has under consideration the building of a bridge across the Annapolis River.

Berlin, Ont.

Tenders will be called next month for the erection of a factory for the Berlin Plate Glass & Mirror Co., estimated cost \$8,000.

Tenders addressed to the chairman, Berlin and Waterloo Hospital Trust, King street-west, will be received for the erection of a Solarium.

The City Council will call tenders in a few weeks for pavements on Victoria, Water and Weber streets; concrete foun-

dation; the surface material has not yet been decided. City Engineer, H. Johnston, C.E.

Brantford, Ont.

The Council Clerk has been instructed to secure information from the Ontario Hydro Power Commission as to where power can be secured for Parkdale, Echo Place and Grand View.

A by-law to be submitted January 26th asking for authority for the expenditure of \$6,558 on sewers on Alice, Gordon, North Park and St. George streets, Henry Ave. and Elliott Ave.

Brussels, Ont.

New tenders, addressed to Malcolm Black, sec. Building Committee, will be received until February 3rd for erection of church and sheds for the Melville Presbyterian Church congregation. Revised plans and specifications at Fox's Drug Store.

Calgary, Alta.

Tenders addressed to the City Commissioners will be received until Jan. 28 for steel cells for police station.

Tenders addressed to the City Commissioners will be received until Jan. 21st for 10,000 feet of lead covered paper insulated underground cable. A cheque for five per cent. of the total amount payable to City of Calgary, must accompany each tender.

Camrose, Alta.

The Calgary Brewing Co., of Calgary, has under consideration the erection of a hotel here at an estimated cost of \$70,000.

Creemore, Ont.

The by-law authorizing the installation of the Hydro-electric system was passed by large majority of the rate-payers.

Dundas, Ont.

W. H. Ball contemplates the erection of a residence, architect for which is not yet appointed.

Edmonton, Alta.

The Edmonton Metals, Limited, has secured a site near the University grounds.

Guelph, Ont.

The Guelph Radial Board has awarded a contract to Preston Car & Coach Co., Preston, Ont., for the supply of two street cars, \$17,500.

Humboldt, Sask.

T. Ford and C. A. Chichester will erect laundry plant if they can secure electric power to operate their machinery.

Jasper Park, Alta.

The Grand Trunk Pacific has plans in progress for the erection of a hotel at this point.

London, Ont.

Plans having been drawn, Vicar Munro, architect, Bank of Toronto Building, will receive tenders on behalf of M. Lerner, for store and apartment house; estimated cost \$8,000.

“Inglis” Corliss Engines

are known above all others as being pre-eminently “Engines of Quality,” Economical, Durable and Reliable and can be depended upon to give the same good results twenty years from now.

We build them Single, Tandem, Compound and Triple, for heavy or light duty. Remember our Fifty year reputation is back of every “INGLIS” engine. Specifications and prices upon request.

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Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses.

File your plans for any work on which you are inviting bids, in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
Toronto Ontario

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Our Engineering Department will gladly assist you in the selection of proper equipment. Literature will be sent at your request.

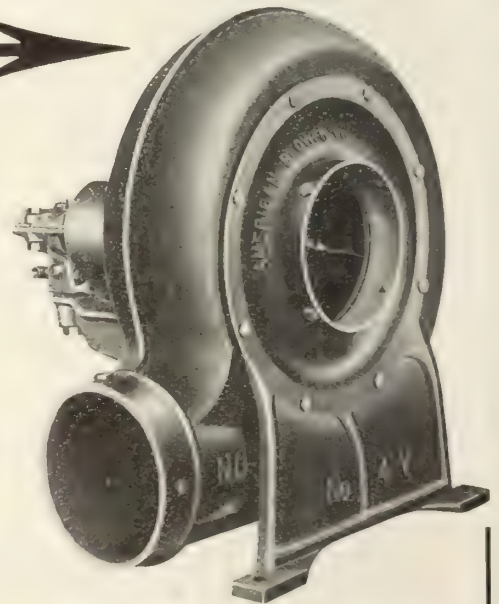
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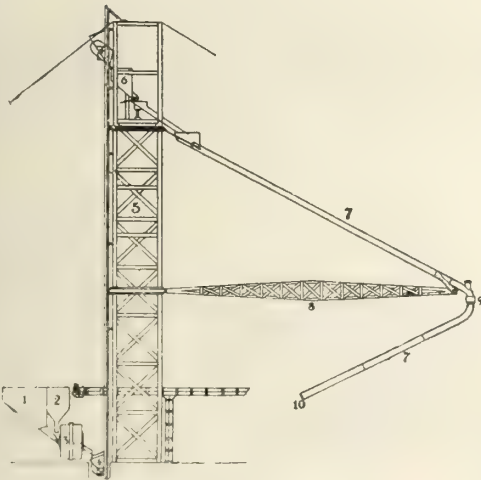
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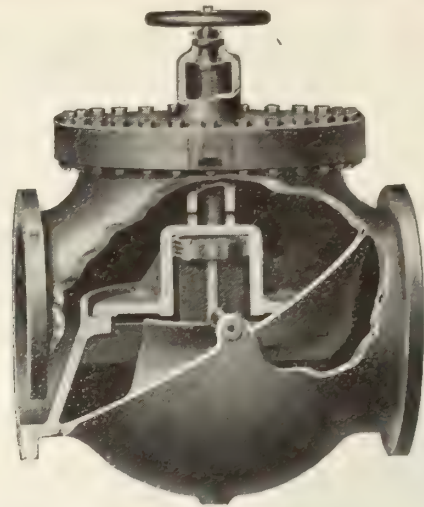
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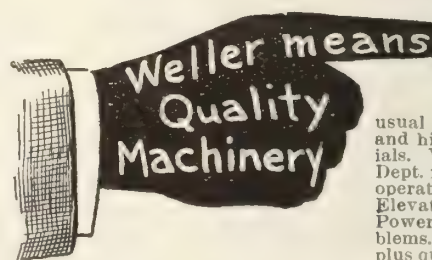


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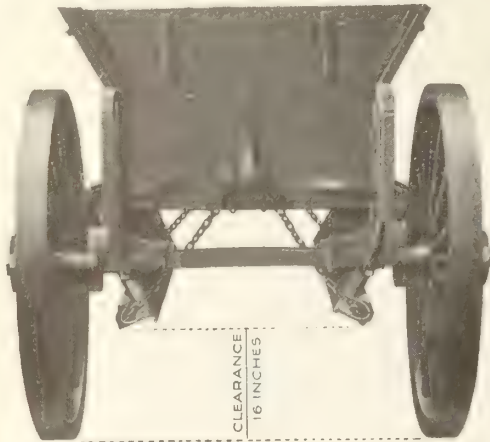
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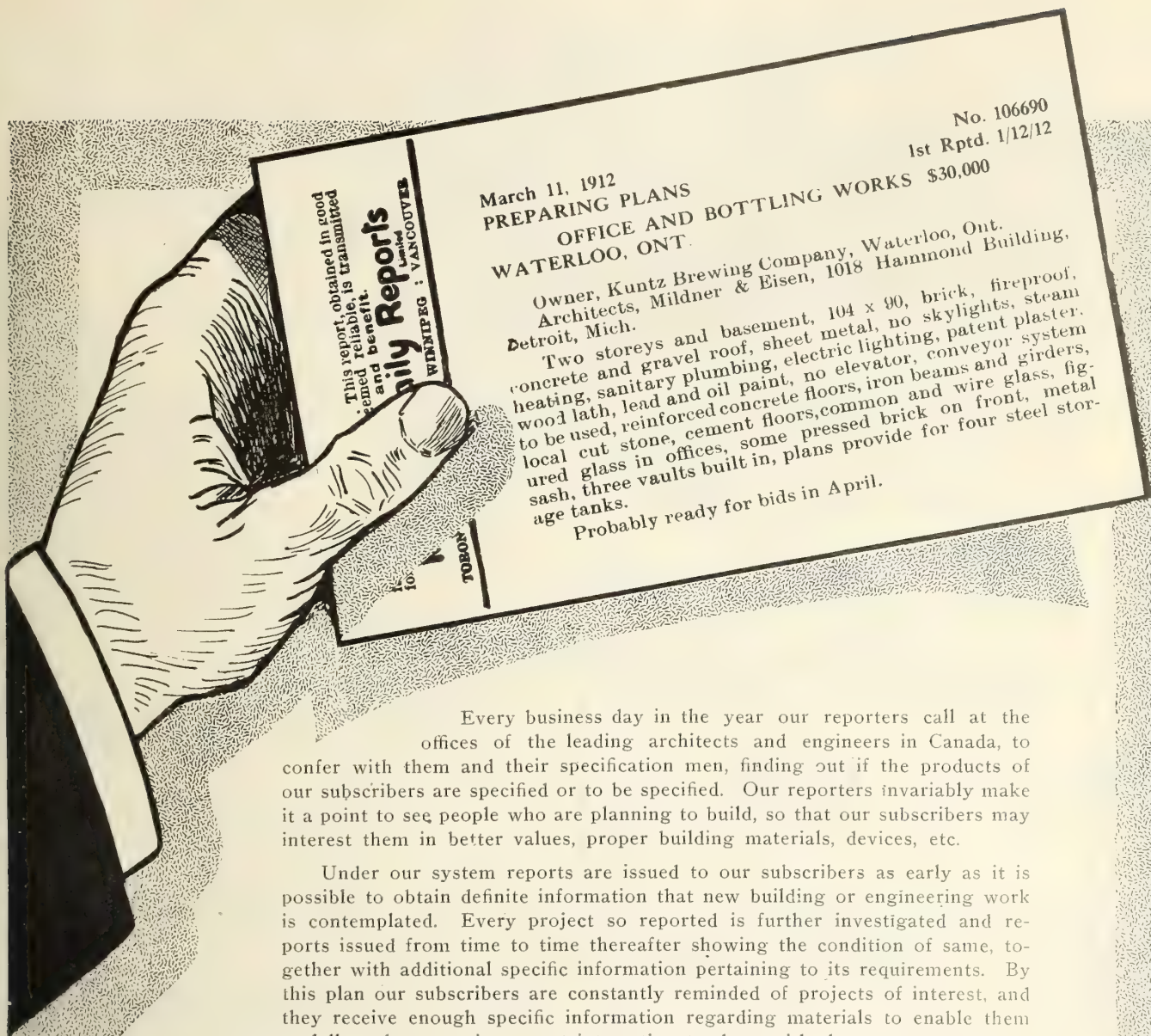
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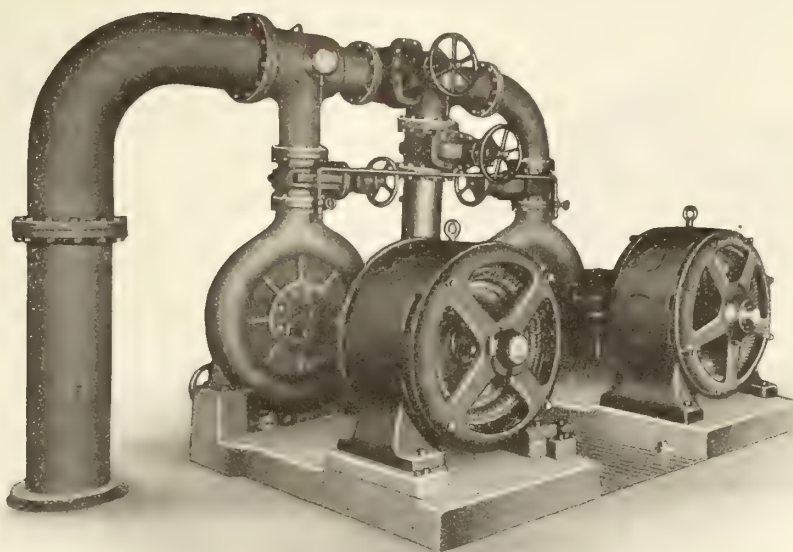
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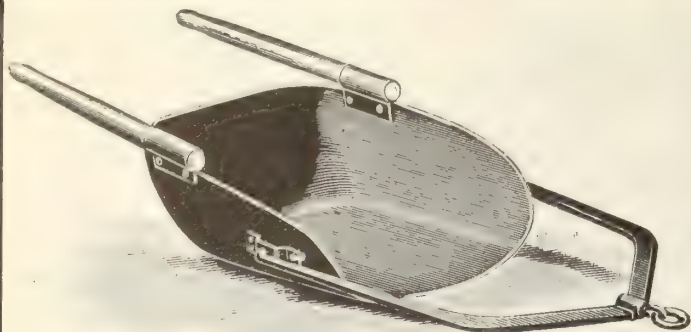
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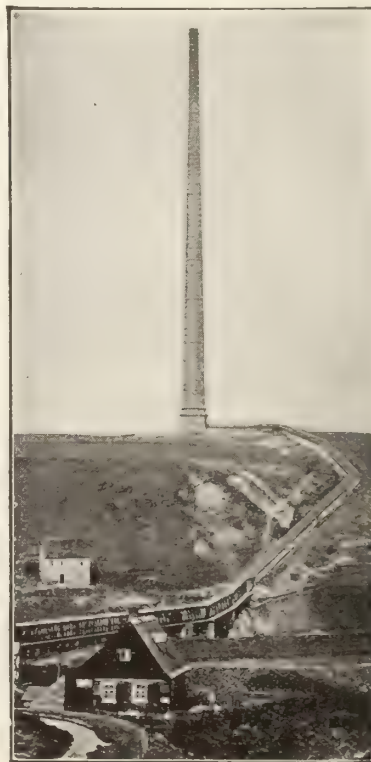
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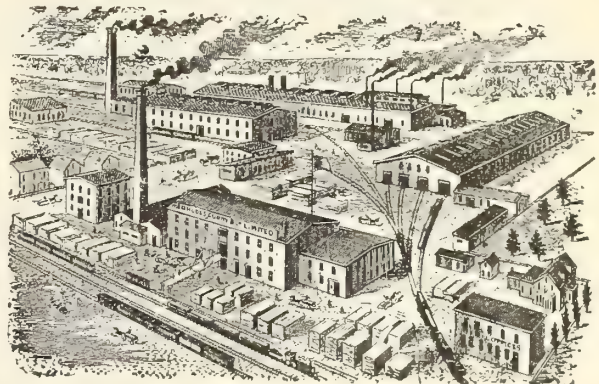
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Main Structural Shop: 130 ft. x 400 ft.

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We build and erect all kinds of Structural Steel Work
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Bars, Angles, Plates, Beams, Channels
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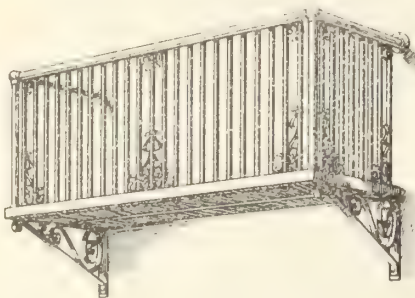
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Two New Sizes

Size in inches	5/8	3/4
Links per foot	6	5 1/2
Weight 100 ft.	410 lbs.	600 lbs.
Proof Test	13,000 lbs.	18,000 lbs.
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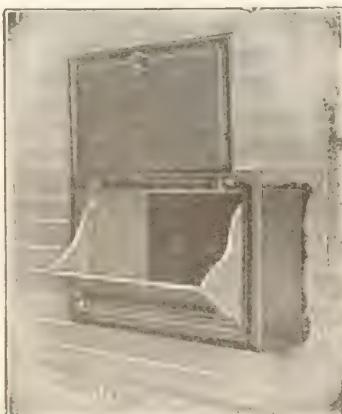
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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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Daily capacity of plant: 40,000.
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Free from bats and culls.
High crushing test.

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Brownhoist Locomotive Cranes



15-Ton Brownhoist Locomotive Crane used by the Independent Stone Co., San Diego, Cali

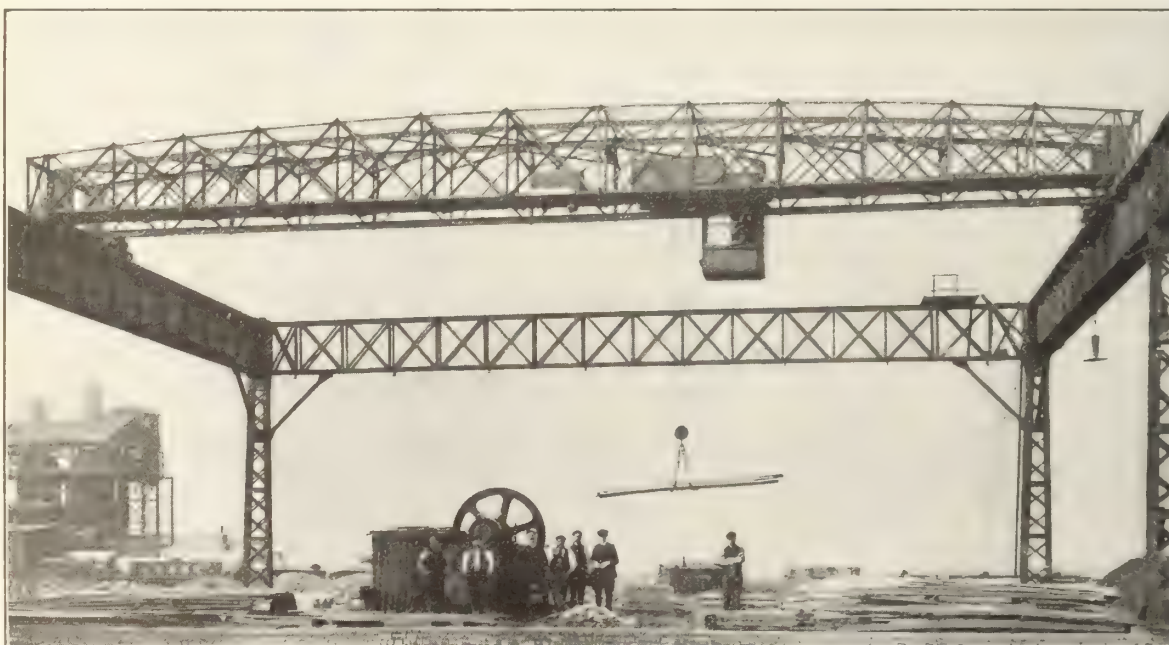
If you handle stone, gravel, sand, coal, etc., you should investigate the use of Brownhoist Locomotive cranes for your work. Each crane, equipped with a Brownhoist Patent Grab Bucket, handles these materials 1 to 2 tons at a load, from

and to stock pile, cars, boats, wagons and bins. And the crane also does the switching of the cars.

These cranes are being used in all sections of the country and you should investigate their operations.

Write for our new catalog K which shows how and where these cranes are being used.

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Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

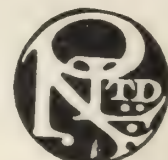
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make roofs that are handsome, *fireproof*, practically everlasting and moderate in price.

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prevents inside fires from spreading. It is quickly applied, and gives a permanent, attractive, yet inexpensive interior finish.

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makes walls and roofs for Garages, Stables, Barns, Warehouses and Factories that are absolutely *weather and fire proof*.

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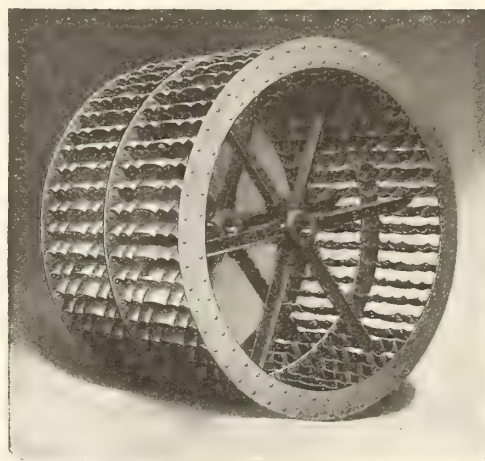
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STURTEVANT Multivane Fans are specified by the leading engineers and architects because of their high efficiency and durability. Contractors prefer these fans because their rugged and accurate construction makes them easy to erect.

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Every STURTEVANT Multivane Fan is backed by the largest builders of fans and fan systems in the world—the

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For water works systems, domestic water supply and hydraulic mining.
Insulated wire conduits; steam pipe casings; acid-proof pipe for
mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

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GRAVEL is cheaper than any other good concrete base.

GRAVEL can be handled for 25% less than any other material.

GRAVEL is easier on your mixers.

GRAVEL goes farther and costs less to set up than concrete made of any other material.

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3 inches to 60 inches diameter

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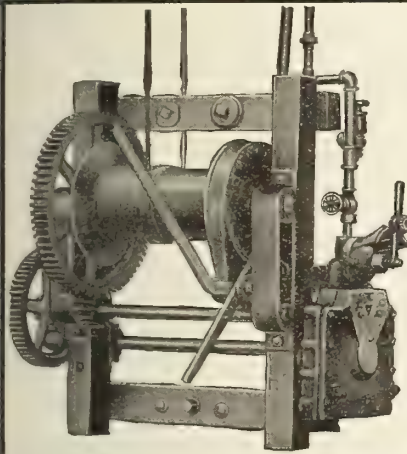
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as well as Rough Quarried Blocks, Dimension
Blocks and all forms of Cut Stone such as Sills,
Lintels, Steps, etc.

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Hard Wall Plaster

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Lake or Rail Shipments

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Current Prices of Building and Engineering Materials

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	\$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Bricks	13 00
Grey Stock Bricks	12 00
Wire cut bricks for foundation work	11 00
Porous terra cotta bricks	15 00
No. 1 enamelled bricks, all colors, from	
.....	\$80 00 to \$150 00
Sand-Lime Bricks	11 00

LUMBER (Building Material)

Hemlock Lumber—	
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	\$28 00
2 x 4 to 2 x 12, 16 ft.	26 00
2 x 4 to 2 x 12, 18 ft.	29 00
1 in. Hemlock, No. 1	25 00
No. 1 Hemlock Decking	26 00
No. 2 Hemlock dimension and 1-in.	19 00

Pine—	
1 in. common pine 8 to 12 in. wide rough	26 00
2 in. white pine Bill stock	29 00
¾ x 8 and 10 in. pine shelving	36 00
¾ x 12 in. pine shelving	45 00
No. 1 white pine flooring	33 00
No. 1 spruce flooring	28 00
No. 1 pine decking D2S	30 00
Spruce Decking	28 00
No. 1 pine V. or headed sheeting	36 00
No. 2 pine V. or headed sheeting	32 00

Pine trim for paint finish—	
4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8 in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—	
XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—	
5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:	
8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	\$3 25	\$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	\$3 50	\$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 65 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 70 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net\$1.85
No. 4½ Fuller's net\$2.35
Square head brass cocks, 65 and 5 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6¼ cents per lb.; traps and bends, 40 per cent.; pig lead, 6¼ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black	Galvanized
¼ inch	\$2.16	¼ inch \$3.06
¾ "	2.16	¾ " 3.06
1 " "	2.64	1 " 3.57
1 ¼ " "	3.05	1 ¼ " 4.20
1 ½ " "	4.51	1 ½ " 6.21

1 ¼ "	6.10	1 ¼ "	8.40
1 ½ "	7.29	1 ½ "	10.04
2 "	9.81	2 "	13.51
2 ½ "	16.80	2 ½ "	21.65
3 "	20.66	3 "	28.31

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 and 10 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in. 25c ft.	15-in. 1.40 ft.
6-in. 40c ft.	18-in. 1.90 ft.
9-in. 70c ft.	20-in. 2.25 ft.
12-in. 1.00 ft.	24-in. 3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.
Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.
Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; ¾-inch, \$1.45.
Burnt River rubble stone delivered, \$16 to \$17 per ton.
Plain steel bars, \$2.25.
Square twisted bars, ¾ to 1½, \$2.35.
Malleable fittings — Canadian discount, 45 and 42½ per cent.
Free stone delivered, \$15 to \$18 per ton.
Brown coursing stone, delivered, \$3.75 per yard.
Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.
Sand, for cement or brick work, \$1.20 a cubic yard, f.o.b. Toronto, C. P. R. siding.
Sand, for cement or brick work, 85c to \$1.00 a cubic yard, f.o.b. Toronto, G. T. R. sidings.
Brown sills and heads, in the rough, delivered, 40 cents per foot.
Rubble stone in car lots, \$1.30 per ton.
Steel channels and beams, angles and plates, \$2.55 to \$2.90 per 100 pounds, delivered f.o.b. Toronto.
Hard Wall Plaster, unsanded, from \$8.00 to \$8.50, bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.
Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.
Plaster of Paris, Anchor and Crown Brands, \$1.50 bbl.
Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, \$8.75 per 100 lbs.
Boiled Linseed Oil in bbls., 65c per gal. of 9 lbs
Raw Linseed Oil, in bbls., 62c per gallon.
Pure Red Lead, dry, \$7.00 to \$8.00 per 100 lbs.
Putty, pure linseed oil, in bulk, bbls., 3¼c.
Putty, pure linseed oil, in 25-lb. tins, 4c.
Turpentine in bbls., 68c.



ERIE
Barrows
Made for
Every Purpose



**Strong,
Durable,
Light
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The Erie Iron Works, Limited

St. Thomas, Ontario

The Largest Crushing Plant in Canada

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Section No. 3, Welland Canal, comprised of a Kennedy No. 42 Gyratory crusher weighing 500,000 pounds with a jaw opening equalling a rectangular opening 3½ feet by 27 feet. Also four No. 6 Kennedy Gyratory crushers. The capacity of this plant will be about 2000 tons per hour.

The entire plant is a Kennedy design and Kennedy built.

As Kennedy Mfg. & Eng. Co.'s sole Canadian agents we are prepared to furnish plans and specifications on mining, quarry or gravel handling plants.

Steam Shovels, also Locomotive Cranes.

Rock & Power Machinery, Limited 12 King Street East, Toronto

P. H. MOORE, General Manager—(Late Manager, Mining, Crushing and Cement Machinery Department, Canadian Allis-Chalmers, Ltd.)

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and King Edward Hotel, Toronto

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The most durable and least expensive Paint made for preserving Iron or Steel in Bridges, Buildings, Structural Shapes, Gas Plants, etc.

Galvanum Paint

The only Paint that will adhere for years to Galvanized Iron roofing, siding, cornices, etc.

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The only Paint that will beautify and make walls, ceilings, tile, concrete, brick and stone walls moist-proof and sanitary. Produced with strong luster finish or semi-luster, or flat finish. Can be frequently washed without injury.

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CANTON, OHIO., U.S.A., and Dock House, Billiter St., LONDON, E.C., ENG.

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Traders' Bank of Canada, Toronto
Structural steel painted with "Superior Graphite Paint"

PROTECTION for ALL kinds of surfaces Guaranteed by using "SUPERIOR GRAPHITE PAINT"



Penstocks
Developing 66,000 horse power, painted with
"Superior Penstock Paints."

The most economical paint that can be used when maintenance cost is considered, for

BRIDGES	STEEL CARS	ROOFS (metal or canvas)	PENSTOCKS
BUILDINGS	STRUCTURAL STEEL	GRAIN ELEVATORS	PIPING
GAS HOLDERS	STACKS AND BOILERS	TANKS	TROLLEY POLES

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Toronto

Made in U. S. A. by DETROIT GRAPHITE CO., Detroit, Mich.

Winnipeg
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White Oak Timbers

We Offer for Sale from Stock Here the Following
Lot of A-1 Grade Oak Timber

Length	Size	Length	Size	Length	Size	Length	Size
60 ft.	12 in. x 15 in.	23 ft.	13 in. x 14 in.	52 ft.	13 in. x 14 in.	38 ft.	12 in. x 14 in.
41 ft.	18 in. x 20 in.	33 ft.	15 in. x 15 in.	51 ft.	18 in. x 19 in.	31 ft.	13 in. x 13 in.
40 ft.	19 in. x 20 in.	43 ft.	18 in. x 19 in.	48 ft.	15 in. x 16 in.	31 ft.	14 in. x 16 in.
32 ft.	12 in. x 15 in.	60 ft.	14 in. x 15 in.	44 ft.	14 in. x 15 in.	35 ft.	14 in. x 15 in.
24 ft.	15 in. x 16 in.	44 ft.	18 in. x 18 in.	43 ft.	18 in. x 19 in.	39 ft.	18 in. x 18 in.
34 ft.	12 in. x 14 in.	43 ft.	16 in. x 16 in.	34 ft.	13 in. x 13 in.	41 ft.	17 in. x 18 in.
25 ft.	14 in. x 14 in.	38 ft.	13 in. x 15 in.	30 ft.	14 in. x 15 in.	42 ft.	16 in. x 18 in.
28 ft.	14 in. x 13 in.	41 ft.	12 in. x 13 in.	21 ft.	15 in. x 16 in.	41 ft.	14 in. x 15 in.
32 ft.	12 in. x 14 in.	37 ft.	13 in. x 14 in.	23 ft.	19 in. x 20 in.	38 ft.	13 in. x 14 in.
28 ft.	16 in. x 16 in.	43 ft.	16 in. x 16 in.	29 ft.	17 in. x 19 in.	27 ft.	14 in. x 17 in.
29 ft.	16 in. x 16 in.	47 ft.	16 in. x 17 in.	34 ft.	14 in. x 15 in.	44 ft.	14 in. x 15 in.
31 ft.	14 in. x 13 in.	43 ft.	15 in. x 16 in.	35 ft.	14 in. x 17 in.	40 ft.	13 in. x 13 in.
33 ft.	13 in. x 14 in.	39 ft.	14 in. x 14 in.	35 ft.	15 in. x 15 in.	41 ft.	13 in. x 14 in.
33 ft.	13 in. x 14 in.	41 ft.	13 in. x 15 in.	31 ft.	12 in. x 13 in.	39 ft.	13 in. x 13 in.

60 Foot Piles on Hand.

Our Mill Runs all Winter.

James Sheppard & Son, Sorel, Que.



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CONSTRUCTED IN SIX MONTHS.

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The Tallest Building in British Empire.

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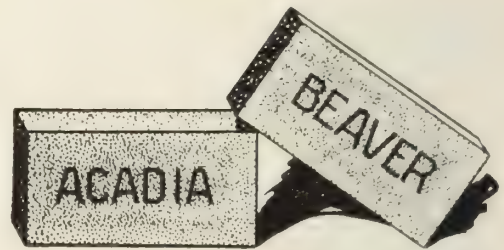
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Uniform Pressed Brick

Many pressed bricks of merit fail to "make good" because they are not uniform in size, or quality, or shade.

In the burning of Acadia and Beaver pressed bricks we have succeeded in producing a brick absolutely uniform in size, in color and in quality.

Always specify Acadia or Beaver brand pressed bricks and you will be satisfied.

Prompt shipment on every order.

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THE TORONTO PLATE GLASS IMPORTING COMPANY, LIMITED

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SIX REASONS

which account for the superiority of

Creosoted Wood Block Pavements

Its Durability; Does not crumble or pulverize under the densest traffic; second only to granite blocks.

Its Ease of Repair; No difficulty being experienced in removing and replacing the blocks; no expensive plant or skilled workmen required.

Its Sanitary Qualities; Creosote being a highly antiseptic and waterproofing material instantly destroys all germs, prevents the absorption of street filth and consequent decay.

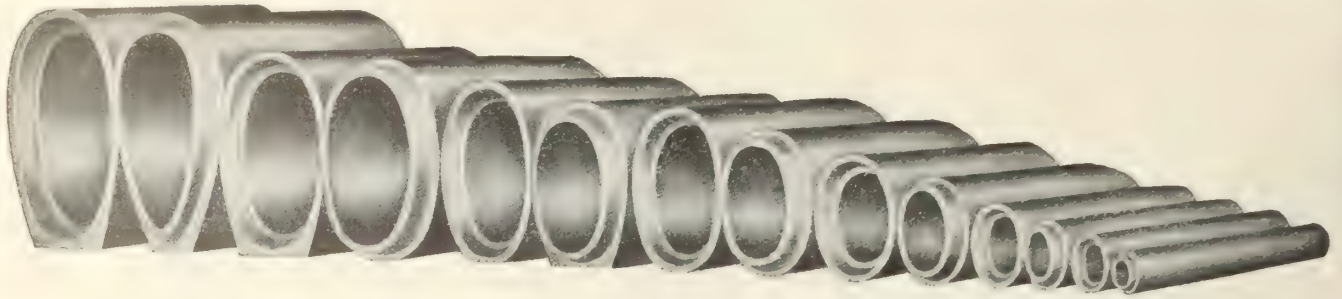
Its Noiselessness; The rattle and bang of vehicles passing over its smooth surface absorbed and muffled till the quiet of the dirt road is obtained.

Its Dustlessness; Does not pulverize; the heaviest traffic only pounding down the wood fibres to offer the greater resistance.

Its Cleanliness; Having a smooth surface and being waterproof it does not differ in this respect from asphalt.

We manufacture blocks of the highest possible standard, the very best materials only being used and in the DOMINION WOOD BLOCKS we believe we produce an article that has no equal.

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Sewers and Culverts

properly built of properly made

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LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS. NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

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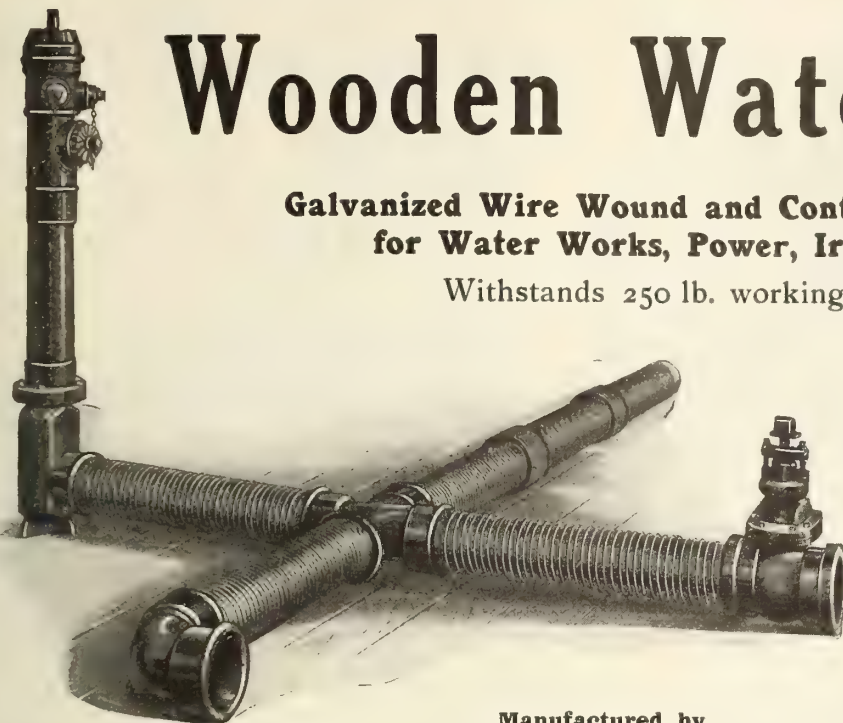
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for Water Works, Power, Irrigation, etc.**

Withstands 250 lb. working pressure.



Not affected by Frost,
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Write for prices.

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We specialize in

**The Built up Pitch, Felt and Gravel Roofing, Damp-proofing
Foundations, Slating, etc.**

We also manufacture

**SKYLIGHTS, CORNICE, FIRE DOORS AND WINDOWS, TIN CLAD DOORS, ASPHALTS,
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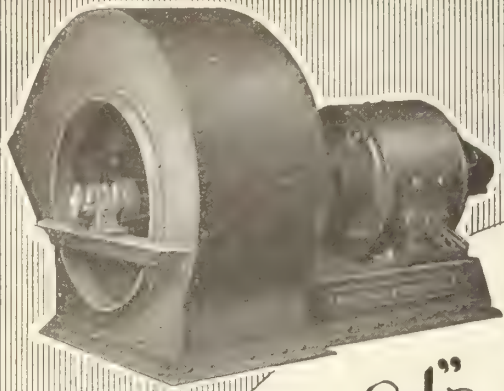
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"Buffalo" Fans

For Heating, Ventilating, Drying and Exhausting.

Ask our engineers to recommend the fan best suited to your requirements. Our designs include the new high-efficiency "Conoidal" multiblade fan, used extensively for heating systems, mine and tunnel ventilation, and the motor-driven *Steel Plate Pressure Blower*, giving pressures up to 24 oz. Both of these designs show higher efficiency than obtained with any similar types. We specialize in *direct-connected* units (motor, engine or turbine driven) for every service.

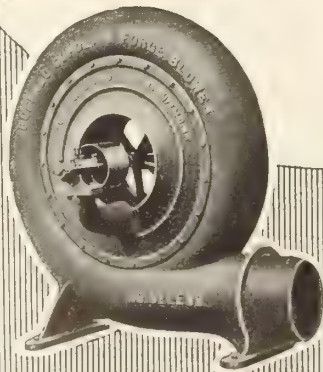
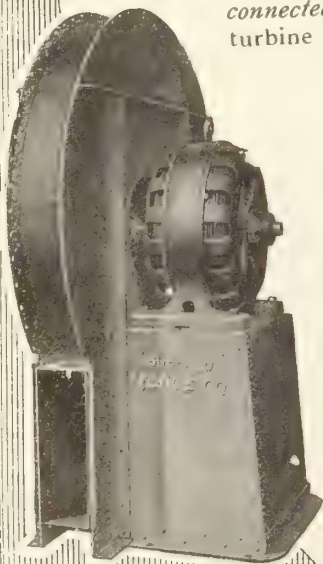
These are distinguished by absence of belt troubles and the very lowest power consumption. Whatever your problem write us.

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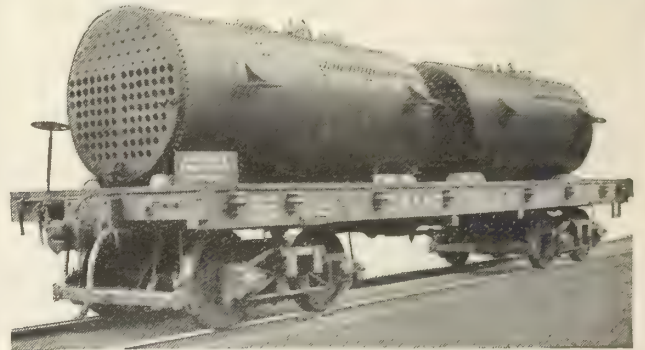
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They are economical of fuel — carry a large reserve steam pressure for use in emergencies — will use hard and dirty water and are easily handled and readily cleaned.

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You will find Waterous Boilers in the largest Industrial and Municipal power plants in Canada.

They are used where service counts.



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Think of a Truck Saving \$43 a Day Over Horses!

The City of Rutland, Vermont, owns a seven-ton Mack Dumping Truck, of which Mayor Clement writes as follows:—

"We moved on an average of 114 tons a day with this truck at a daily cost of \$5. If this same work were done by teams it would require at least 12 teams costing, in this city, \$4 each."

As it cost them only \$5 a day to operate the Mack Truck this makes a saving of \$43 a day over horses, and yet this is nothing extraordinary.

We have records of hundreds of Mack Trucks earning from \$30 to \$50 per day. Those who are not getting this result have not adjusted their business conditions to fit the motor truck unit.

An investment in motor trucks can be utilized



A seven-ton Mack Truck doing the work of eight mule teams in the construction of macadam road.

twenty hours per day if desired, can double up in rush seasons, and does not deteriorate or wear out when idle.

The opportunities for utilizing the motor truck in contracting work are many and varied.

Would you like to know what motor trucks have done for other engineers and contractors? We have the data for you.

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10



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This picture shows the

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This building was wired with

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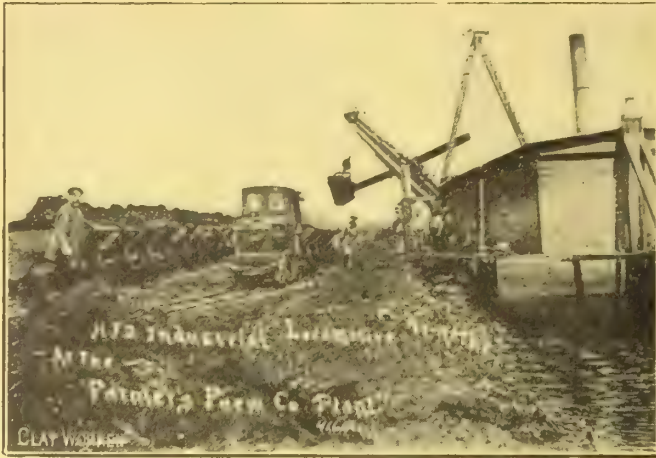
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Steam and Gasoline

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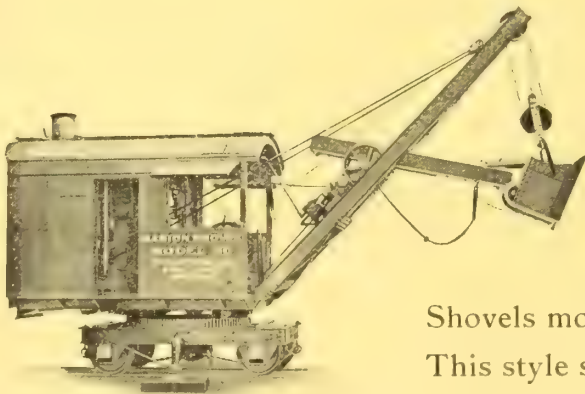
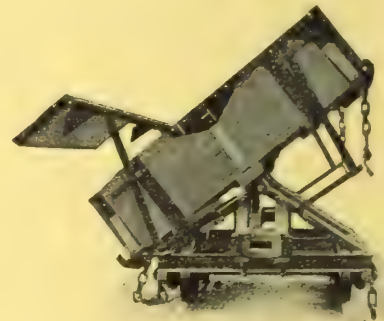
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All sizes for any practical gauge

We will be pleased to submit full particulars.

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We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.



“MARION” STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
5 8 - 1 and 1 1/2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks.
This style shovel is specially adapted for Brickyards—Mines
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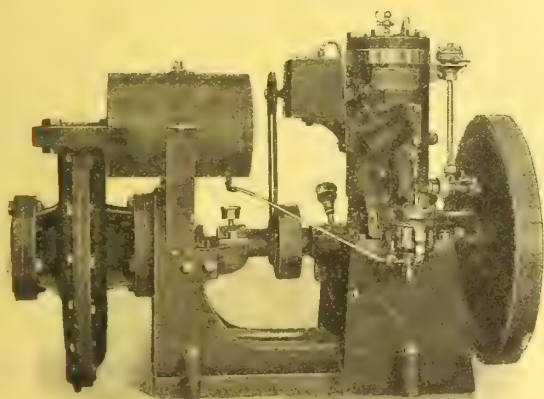
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Entire satisfaction guaranteed



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Made in all
Kinds of
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Large Bent Plate Glass for Shop
Fronts a Specialty

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OF BELLISS MAKE

have gained their reputation for

Simplicity of Design
Noiseless Running
Compact Design
Low Oil Consumption
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Continuous and Machine Banded Wood Stave

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RESERVOIR TANKS

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One-half the cost of Iron Pipe—
and better.

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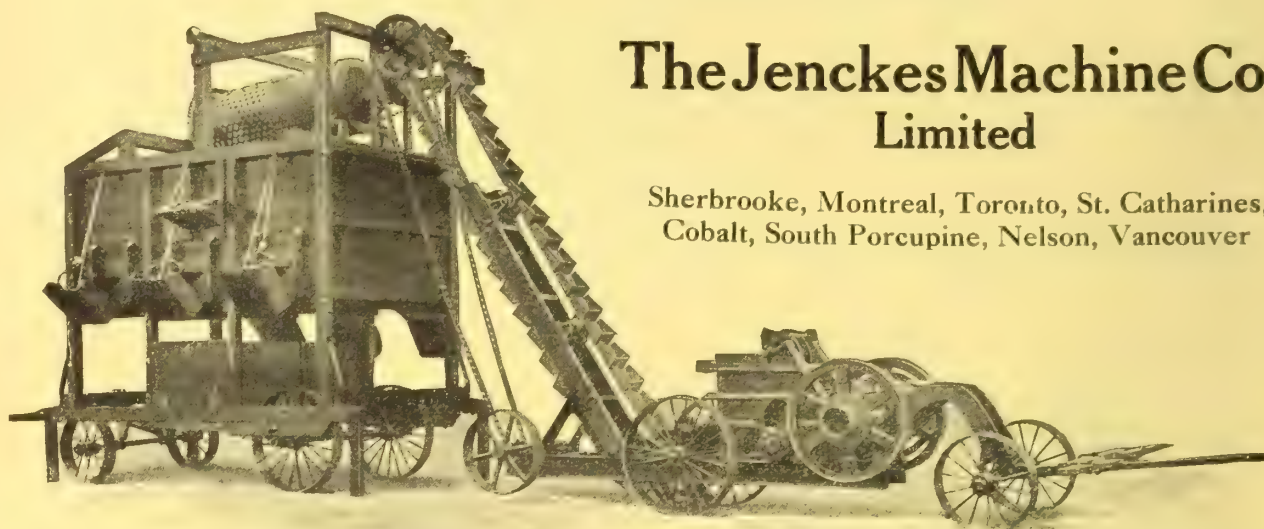
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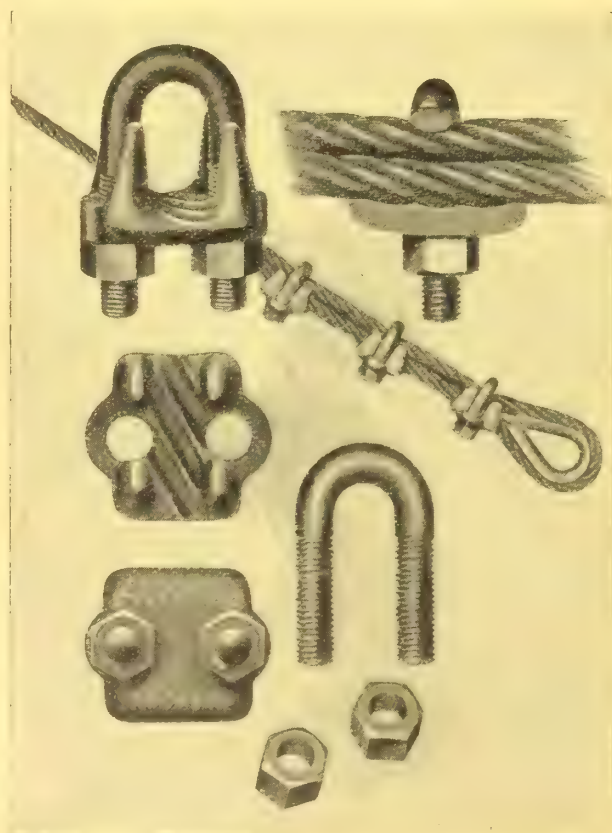
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"CROSBY" CLIPS ALL WAYS, ALWAYS

The one absolutely secure and dependable wire rope fastening is the drop forged steel, galvanized

"CROSBY" CLIP

Built for greatest gripping power—immune to rust.

IT HOLDS

In the interests of safety use no other on guy or hoisting lines.

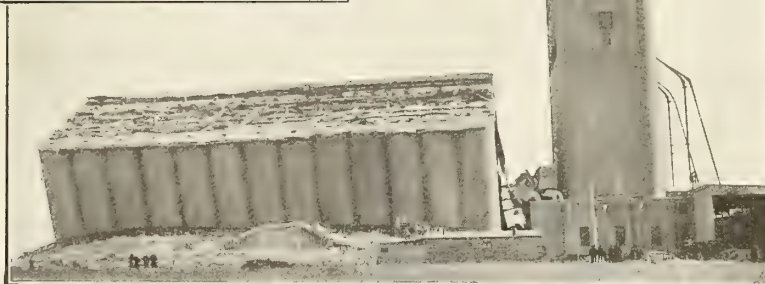
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Views of both sides of the million bushel C. P. R. Concrete Grain Elevator at Transcona, Man., which settled on its foundations to an angle of 30 degrees from perpendicular without injury to the structure or its contents.



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Now, right in our very midst, comes a striking illustration of concrete's enormous power of resistance and durability.

This great concrete structure, built only to resist the pressure of grain from the inside, while filled almost to capacity with 55,000,000 pounds, or 27,500 tons of grain, settled to an angle of 30 degrees from its original perpendicular position.

In the settling, the walls were subjected not only to the terrific twisting strain of their own weight, but to the weight of thousands of tons of grain as well.

Contract for the restoration of this enormous structure has been awarded to Barnett & McQueen, and it is anticipated that it will be put back into its original position without the slightest injury.

No Loss of Contents

Think of the irreparable loss, had this elevator been built of some destructible material—a material that would have collapsed almost as soon as the settling commenced, and which would have entailed not only the loss of the building, but almost a total loss of its contents.

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at
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Job.**

MARSH & HENTHORN
HOISTING
ENGINES

will stand right up to the work.
The material and workmanship
of the M. & H. is first-class and
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**Steam, Electric,
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Horse
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Hoists**

Standard sizes carried in
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Berg Machinery Mfg. Co.
Sheldons Limited
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Canadian Allis-Chalmers, Ltd.
Canadian Bridge Co.
Chicago Bridge & Iron Works
Des Moines Bridge & Iron Co.
Dickson Bridge Works
Dominion Bridge Co.
Hamilton Bridge Works Co.
Mackinnon-Holmes & Co.
Manitoba Bridge & Iron Works
Maritime Bridge Company
National Bridge Co.
Phoenix Bridge & Iron Works
Sarnia Bridge Co.
Scherzer Rolling Lift Bridge Co.
Structural Steel Co.
Standard Steel Construction Co.
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Canadian Sirocco Co.
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Sheldons Limited.
- Buckets**
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Browning Company
Canadian Fairbanks-Morse Co.
Lecky & Collis
Manitoba Bridge & Iron Works.
Thew Shovel Company
Weller Mfg. Co.
- Builders Hardware**
Richards-Wilcox Canadian Co.
- Cable**
Canada Wire & Cable Co.
Imperial Wire & Cable Co.
Standard Underground Cable Co.
of Canada, Limited
- Cement**
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Britnell & Co.
Bremner, Alex.
Canada Cement Co.
McNally & Co., W.
Morrison & Co., T. A.
Ontario Lime Co., Ltd.
Rogers, Alfred, Limited
Smyth & Ryan
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Abram Cement Tool Co.
Wettlaufer Bros.
- Chain**
McKinnon Chain Co.
- Chain Blocks**
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Galt Stove & Furnace Co
Manitoba Bridge & Iron Works.
- Coal Handling Apparatus**
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Browning Company
Brown Hoisting Machinery Co.
Weller Mfg. Co.
- Combination Woodworkers**
Hutchinson, M.
- Concrete Mixers and Appliances**
Austin Drainage Excavator Company, F. C.
Canadian Allis-Chalmers, Ltd.
Canadian Concrete Appliance Co.
Hopkins & Co., F. H.
Lecky & Collis
London Concrete Machinery Co.
Municipal Engineering & Contracting Co.
Mussens Limited
Wettlaufer Bros.
- Contractors' Barrows**
Erie Iron Works
- Conduits**
Can. H. W. Johns-Manville Co.
Conduits Co., Limited
Orpen Conduit Mfg. Co. of Can.
- Contractors**
Eastern Pipe Construction Co.
Foundation Company, Limited
Reggin & Spence
Wells & Gray.
- Contractors' Plant & Supplies**
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Barber Asphalt Paving Co.
Batenian Wilkinson Co.
Beatty & Sons, M.
Browning Company
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Canadian Fairbanks-Morse Co.
Canadian Locomotive Company
Canadian Brakeshoe Co. Limited
Canadian Concrete Appliance Co.
Dake Engine Co.
Dore & Fils
Dull Co., Raymond W.
Erie Iron Works
Hamilton Mfg. Co., Wm.
Hepburn & Co., J. T.
Honig & Mock.
Hopkins & Co., F. H.
Lecky & Collis
Marsh & Henthorn
McKinnon Chain Co.
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Municipal Engineering & Contracting Co.
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Stinson-Reeb Builders' Supply Co.
Wettlaufer Bros.
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Weller Mfg. Company
- Core Drills**
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- Cork Installation Machinery**
Linde British Refrigeration Co.
- Corrugated Iron**
Can. H. W. Johns-Manville Co.
Metallic Roofing Co.
Ormsby, A. B., Limited
- Cranes, Travelling and Locomotive**
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W. D. Beath & Son
Browning Company.
Brown Hoisting Machinery Co.
International Marine Signal Co.
Morris Crane & Hoist Co., Herbert.
Northern Crane Works.
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Royce Limited
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Cabot, Inc., Samuel
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Hagersville Contracting Co.
Ontario Lime Co., Ltd.
Rogers Supply Company
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Hopkins & Co., F. H.
Jenckes Machine Co.
Lecky & Collis
London Concrete Machinery Co.
Mussens Limited
Wettlaufer Bros.
- Cupolas (Foundry)**
Northern Crane works
- Culverts**
Pedlar People.
- Derricks and Derrick Fittings.**
American Hoist & Derrick Co.
W. D. Beath & Son
Hepburn, John T.
- Dredges**
Beatty & Sons, M.
Browning Company.
- Drills**
Beatty & Sons, M.
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis
Star Expansion Bolt Co.
- Drill Steel Sharpeners**
Canadian Ingersoll-Rand Co.
- Drop Forgings**
Canadian Billings & Spencer, Ltd.
- Dump Cars, Wheels, etc.**
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Troy Wagon Works
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- Electrical Machinery and Supplies**
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Roelofson Elevator Works.
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Canadian Buffalo Forge Co.
Canadian Sirocco Co.
Ingles Co., John
Jenckes Machine Co.
Laurie & Lamb
Leonard & Sons, E.
McDougall Caledonian Iron Wks.
Mussens Limited
Sturtevant Co. of Can Ltd., B. F.
Waterous Engine Works Co.
Wettlaufer Bros.
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Bowman & Connor
Campbell, R.
Chipman & Power
Dominion Engineering & Inspection Company.
Farmer, John T.
Galt Engineering Co., John
Lea & Ferguson
Mitchell, C. H.
Thorold Co., F. W.
- Excavators**
Austin Drainage Excavator Company, F. C.
Municipal Engineering & Contracting Company.
- Expansion Bolts**
Star Expansion Bolt Co.
- Expanded Metal**
Mannesmann Tube Co.
- Exhaust Heads**
Canadian Buffalo Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.
- Fans**
Canadian Sirocco Co.
Sheldons Limited.
- Field Instruments**
Gurley, W. & L. E.
- Filters**
American Water Softener Co.

(Continued on page 12)



Residence of W. W. Butler, Cote St. Antoine Road, Montreal.
Robt. Findlay, 10 Phillips Place, Architect.

Don Valley Brick

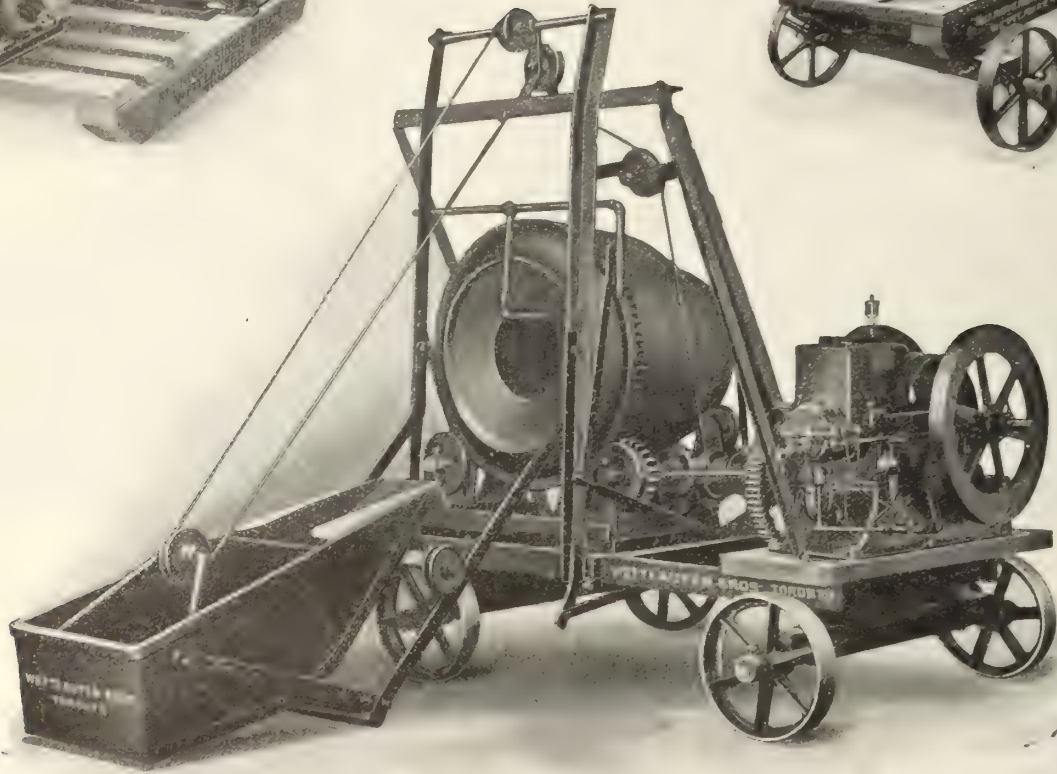
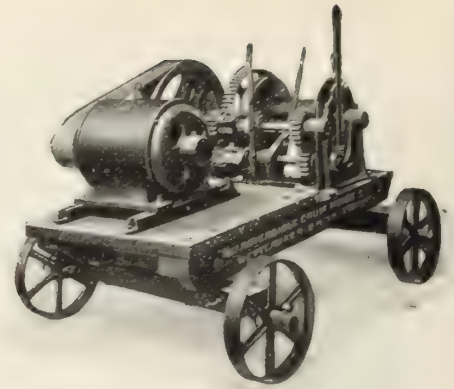
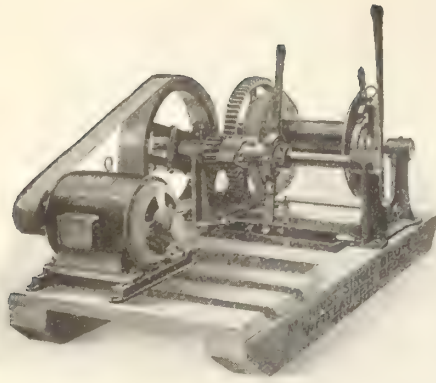
FOR the largest buildings, the finest residences and brick work in general Don Valley Brick stands pre-eminent.

The illustration shows a handsome Montreal residence in which Don Valley Bricks were used. The resultant rich effect of the brick work thoroughly justified the architect in specifying "Don Valley Bricks."

Don Valley Porous Terra Cotta Fireproofing is used for fireproofing most large buildings.

Don Valley Brick Works

Toronto, Ontario



Wettlaufer Contractors' Equipment

Concrete Mixers, Steam and Electric Hoists, Brick Machines, Pumps, Crushers, Stone Screens, Gasoline Engines, Steam Engines and Boilers,

Write us for particulars

Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

AGENCIES:

A. E. Hodgert, Regina, Sask.; Maysmith & Lowe, 1057 Mears St., Victoria, B.C.; A. R. Williams Machinery Co., 15 Dock St., St. John, N.B.; The Canadian British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man.; R. F. Mancill, 117 10th Ave. East, Calgary; The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C.; J. L. Tachance, Ltd. 363 St. Paul St., Quebec; Wettlaufer Bros., 316 Lagauchetiere St. W., Montreal.

Cement and Crushed Stone

For difficult concrete construction where the highest quality cement and sharp clean stone are required we ask you to specify Rogers.' Our cement will stand all your tests.

125' x 5' reinforced concrete chimney. Built for the Dominion Cannery Co., Limited, by The Weber Chimney Co., Chicago.

Rogers' Cement used.



Alfred Rogers
Limited
28 King Street West
Toronto

MILLS AT
St. Marys
Hanover
Kirkfield
Orangeville
Owen Sound

QUARRIES AT
Vinemount
Dundas

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

VITREOUS FACE BRICK



OUR BRICK SHOWROOM IN MAIL BUILDING

Astrakhan Brick

Bokhara “

Kushequa “

Moquette “

Shawnee “

Turkestan “

**Rough and Smooth
Surfaces**

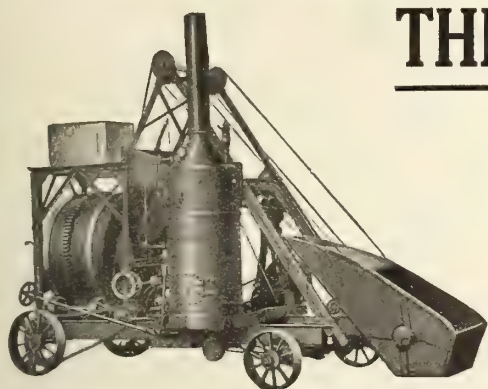
**Salt Glazed, Enamel
and Paving Bricks**

**Selected Fireplace
Brick Carried in
Stock**

BLACK BUILDING SUPPLY CO., LTD. - TORONTO

WHY are we the Largest Manufacturers of ? Concrete Machinery in Canada ?

THERE MUST BE A REASON



Rear Discharge Traction Mixer. This machine is also equipped with Boom.

The reason is that our machines have always been made up to a standard, not down to a price. This fact has been recognised by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.

London Concrete Machinery Company, Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:

WINNIPEG (445 Main St.) W. H. Rosevear, Mgr.

TORONTO (36 Alhambra Ave.) F. D. Emsley, Mgr.

CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.

AGENCIES:

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MOOSE JAW, Sask. Bridge & Iron Co., Ltd.

REGINA, H. A. Knight

FORT WILLIAM, Northern Eng. & Supply Co.

MONTREAL, Foss & Hill Mach. Co.

QUEBEC, A. D. Masson

Old Houses Made New

In time the frost springs the clapboards apart and then your walls leak wind. Did you notice the heavy coal bill last Winter? Instead of painting you should overcoat your house with cement plaster.

Herringbone Metal Lath

is ideal for the purpose. Merely nail it directly to your old siding and apply the plaster. It is perfectly self-furring.

Write for full information. Don't wait for another big coal bill.

Clarence W. Noble,

General Sales Agent

Winnipeg

117 Home Life Building, TORONTO

Montreal

The Metal Shingle & Siding Company, Manufacturers

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- | | | | |
|--|---|---|---|
| <p>Fire Brick
Improved Equipment Co.
Ontario Lime Co., Ltd.
Smyth & Ryan</p> <p>Fire Escapes
Manitoba Bridge & Iron Works.
McGregor & McIntyre</p> <p>Fireproof Doors and Windows
Feather & Roadhouse
Metal Shingle & Siding Co.
Mussens Limited
Ormsby Co., Limited, A. B.
Steel & Radiation Limited</p> <p>Fuse (Safety Blasting)
Lecky & Collis</p> <p>Fixtures (Gas)
Consumers Gas Co.</p> <p>Forges
Canadian Buffalo Forge Co.
Sheldons Limited
Canadian Sirocco Co.</p> <p>Forgings
Canadian Billings & Spencer, Ltd.</p> <p>Furnaces (Special)
Improved Equipment Co.</p> <p>Gasoline Engines
Wettlaufer Bros.</p> <p>Gas Plants Complete
Improved Equipment Co.</p> <p>Gas Producers for Heating
Improved Equipment Co.</p> | <p>Gas Machinery
Improved Equipment Co.</p> <p>Glass
Consolidated Glass Co.
Hobbs Mfg. Co.
Luxfer Prism Co.
Toronto Plate Glass Imp't'g Co.</p> <p>Gravel Washing Plants
Dull Co., Raymond W.</p> <p>Hammer Drills
Canadian Ingersoll-Rand Co.</p> <p>High Pressure Pipe Lines
Boving Company of Canada
Escher Wyss & Co.
Mannesmann Tube Company.
Pittsburgh Valve, Foundry & Construction Company</p> <p>Hoists
Northern Crane Works.
Roelofson Elevator Works</p> <p>Hoisting Apparatus
American Hoist & Derrick Co.
Beatty & Sons, M.
Browning Company
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Jenckes Machine Co.
Hopkins & Co., F. H.
Lecky & Collis
Marsh & Henthorn
Morris Hoist & Crane Co., Herbert.
Mussens Limited
Royce Limited
Sturtevant Co. of Can. Ltd., B. F.</p> | <p>Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Co.
Sheldons Limited</p> <p>Hoisting Engines
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Wettlaufer Bros.</p> <p>Hydrants
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company</p> <p>Ice-making Machinery
Linde British Refrigeration Co.</p> <p>Insulating Compounds
Standard Underground Cable Co. of Canada, Limited</p> <p>Interior Finish and Doors
Batts Limited
Canada Office & School Fur. Co.
Rhodes Curry & Co.</p> <p>Jib Cranes (all kinds)
Morris Crane & Hoist Co., Herbert.</p> <p>Kilns
Canadian Buffalo Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.
Canadian Sirocco Co.
Berg Machinery Mfg. Co.</p> <p>Lighting and Pumping Installations
Lister & Co., Ltd., R. A.</p> <p>Lime
Jamieson Lime Co.
Ontario Lime Co., Ltd.</p> | <p>Lime Kilns
Improved Equipment Co.</p> <p>Locomotives
Boving Company of Canada
Canadian Allis-Chalmers, Ltd.
Canadian Locomotive Company
Montreal Locomotive Works
F. H. Hopkins Co.
Mussens Limited</p> <p>Marble
Mississquoi-Lautz Corporation</p> <p>Metal Lath
Greening Wire Co., B.
Metallic Roofing Co.
Noble, C. W.
Steel & Radiation Ltd.</p> <p>Meters, Electrical
Ferranti Electrical Mfg. Co.
Canadian Allis-Chalmers, Ltd.</p> <p>Meters, Water
Hopkins & Co., F. H.
McDougall Caledonian Iron Wks.
Neptune Meter Co.</p> <p>Overhead Runways
Morris Crane & Hoist Co., Herbert.</p> <p>Paints and Varnishes
Dominion Paint Works
Goheen Mfg. Co.
Hopkins & Co., F. H.
Montreal Locomotive Works
Mussens Limited
Rock & Power Machinery, Ltd.
Thew Automatic Shovel Co.</p> |
|--|---|---|---|

(Continued on Page 14)



Ferranti Transformers

A transformer to be efficient must be economical to install, economical to operate and must have a minimum of core and copper loss. These good points will be found in Ferranti Three Phase Transformers.

Whether on the line or in the station Ferranti Transformers will give all-day high efficiency.

The design is very substantial and all parts are easily accessible.

Let us quote you prices

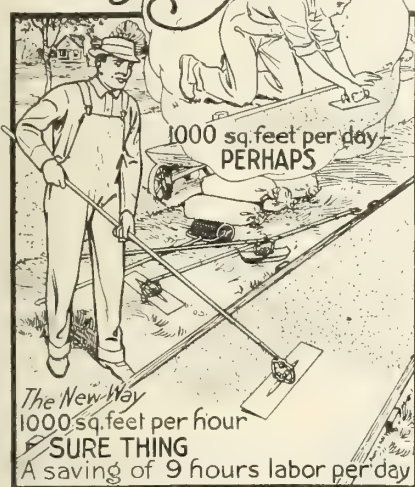
The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

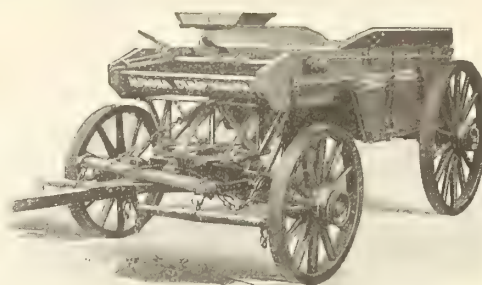
Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG

If you are not using
"ABRAM"
TOOLS

It is plain to be seen
 you are
 losing money



Abram Cement Tool Co.
 Windsor, Ontario



WESTERN

This name on a dump wagon signifies the dawn of a new era in the handling of earth and stone.

The new model Western Dump Wagon has met with enthusiastic praise among contractors and other users.

A new feature in this wagon and one that strengthens more than ever its claim to superiority over any other make of dump wagon, is the addition of a steel channel filled with wood for the main side board.

This innovation gives unusual strength and makes breakage practically impossible.

WRITE US FOR BOOKLET

Western Wheeled Scraper Co.
 AURORA, ILLINOIS

Earth and Stone Handling Machinery
 Dominion Equipment & Supply Co., Winnipeg-Calgary-
 Edmonton—Agents for Manitoba, Saskatchewan & Alberta
 Canadian Equipment Co., Montreal
 Agents for Eastern Canada

Macadam Roads



*must be built
 of a*

Tough Stone

*that
 will cement*

WE HAVE IT

The Hagersville Contracting Company, Limited
 Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued**Paving and Paving Materials**

Asphalt & Supply Co.
Aztec Oil Asphalt Co.
Barber Asphalt Paving Co.
Dominion Creosoting Company
Ontario Asphalt Block Co.
Paterson Mfg. Co., B.

Perforated Metals

Canada Wire & Iron Goods Co.
Greening Wire Co., B.

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American Spiral Pipe Works
Canadian Allis-Chalmers, Ltd.
Canadian Pipe Co.
Dominion Concrete Co.
Dominion Wood Pipe Co.
Gartshore-Thomson Pipe Co.
Mannesmann Tube Company.
National Iron Works
National Pipe & Foundry Co.
Pacific Coast Pipe Co.
Piggott & Co., Thos.
Walsh Plate & Structural Works.

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Browning Company
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Sheldons Limited
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Albert Mfg. Company
Britnell & Company
Ontario Lime Co., Ltd.

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Mueller Mfg. Co., H.

Plumbing

Dietrich Limited

Pneumatic Machinery

Canadian Ingersoll-Rand Co.

Portable Saws

Canadian Fairbanks-Morse Co.

Portable Track

Bechtels Limited

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Jenckes Machine Company
Canadian Allis-Chalmers, Ltd.
Waterous Engine Works

Pumps and Pumping Machinery

Beatty & Sons, M.
Boving Company of Canada
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Canadian Sirocco Co.
Cook, A. D.
Hamilton Mfg. Co., Wm.
Honig & Mock.
Inglis & Company, John
McDougall Caledonian Iron Wks.
Smart-Turner Machine Co.
Waterous Engine Works Co.
Mussens Limited
Ontario Wind Eng. & Pump Co.
Wettlaufer Bros.

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Improved Equipment Co.
Lecky & Collis
George Anderson & Co.
Rock & Power Machinery, Ltd.

Radial Brick Chimneys

H. R. Heinicke Inc

Railway Supplies

Gartshore, John J.
Hopkins & Co., F. H.
Lecky & Collis
Mussens Limited

Refrigeration Machinery

Equipment & Supplies, Limited.
Linde British Refrigeration Co.

Revolving Stone Screens

Greening Wire Co., B.

Reinforcements, Concrete & Steel

Canada Steel Co., Ltd.
Canada Wire & Iron Goods Co.
Greening Wire Co., B.
Steel Company of Canada
Steel & Radiation Ltd.
Trussed Concrete Steel Co.

Road Asphalt

Barber Asphalt Paving Co.
Asphalt & Supply Co.

Road Machinery

Dore & Fils
Lecky & Collis
Morrison & Co., T. A.
Mussens Limited
Waterous Engine Works Co.
Western Wheeled Scraper Co.

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Goodyear Tire & Rubber Co.
Canadian Fairbanks-Morse Co.

Roofing Material

Asbestos Mfg. Company
Barber Asphalt Paving Co.
Bird & Sons, F. W.
Can. H. W. Johns-Manville Co.
Metallic Roofing Company
Noble, Clarence W.
Paterson Mfg. Co.

Safes and Vaults

Taylor, J. & J.

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Ontario Lime Co., Ltd.
Sand and Supplies Limited
York Sand and Gravel Co.
Alfred Rogers Limited

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Greening Wire Mfg. Co., B.
Weller Mfg. Co.

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Canada Iron Corporation
Dominion Sewer Pipe Co.
Gartshore-Thomson Pipe Co.
National Iron Works
Nova Scotia Clay Works Ltd.
Ontario Lime Co., Ltd.
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.

Sewer Trenching

Lecky & Collis

Sound Deadening

Cabot, Inc., Samuel

Shovels (Steam)

Browning Co.
Beatty & Sons, M.
Canadian Allis-Chalmers, Ltd.

(Continued on page 15)

What Big Contractors

Say About This Koppel Car

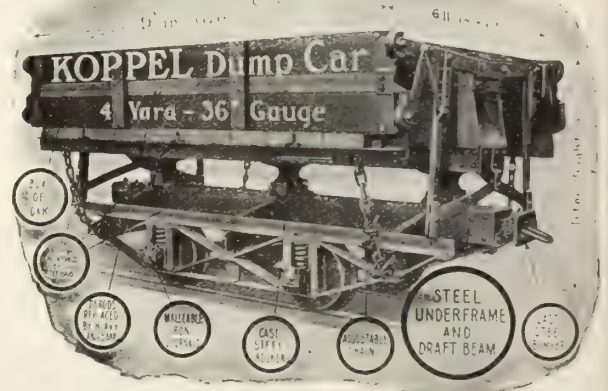
Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.



Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

"Tested Packings For Every Purpose"

This pamphlet is an authentic text-book—
a complete illustrated guide—to standard lines
of tested packings.

We shall be glad to send you a copy,
gratis.

Canadian Consolidated Rubber Co.
Limited
Montreal

Please use this coupon



Canadian
Consolidated
Rubber Co., Ltd.
Montreal

Gentlemen:
Please send me a compliment-
ary copy of "Tested Packings for
Every Purpose."

Name.....

Address.....

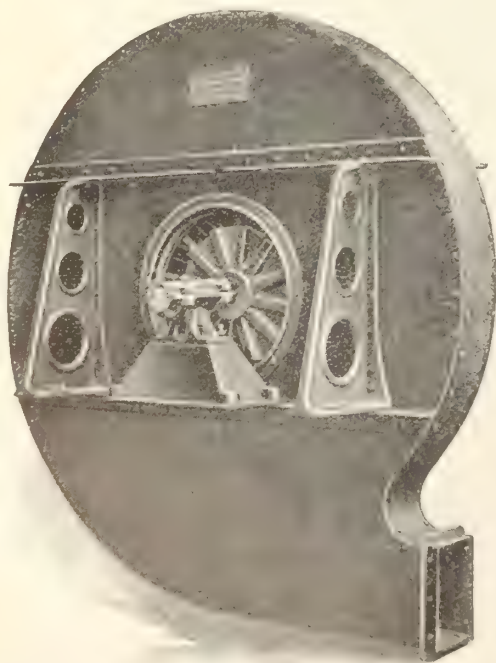
CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

- Paints (Bridge and Structural Iron and Pipe Coating)**
 Dominion Paint Works
 Goheen Mfg. Co.
 Ottawa Paint Co.
- Smoke Stacks**
 Chicago Bridge & Iron Works
 Des Moines Bridge Co.
 Hamilton Mfg. Co., Wm.
 Manitoba Bridge & Iron Works.
 Walsh Plate & Structural Works
- Stains, Shingle, Cement & Brick**
 Cabot, Inc., Samuel
- Stair Builders**
 McGregor & McIntyre
- Steam Apparatus and Specialties**
 Canadian Buffalo Forge Co.
 Pittsburgh Valve, Foundry and Construction Company
 Sheldons Limited
 Sturtevant Co. of Can. Ltd. B. F.
- Steel Tubes**
 Mannesmann Tube Co.
- Steam Turbines**
 Canadian Allis-Chalmers, Ltd.
 McDougall Caledonian Iron Wks.
- Steel**
 Canada Steel Co., Ltd.
 Can. Billings & Spencer
 Lecky & Collis
- Steel Bars**
 Canada Steel Co., Ltd.
 Steel Co. of Canada
 Steel & Radiation, Ltd.
- Steel Pipe**
 Gerald Lomer, Limited
 Mannesmann Tube Company.
- Stone**
 Britnell & Company
 Brodie, James
 Consolidated Stone Company
 Contractors' Supply Company
 Crushed Stone, Limited
 Hagersville Contracting Co.
 Mahan & Company
 McMillan & Son, W.
 Morrison & Co., T. A.
 Myers, Oakley
 Ontario Lime Co., Ltd.
 Queenstown Quarry Co.
 Rogers Supply Company
 Sackville Freestone Company
 Sand & Supplies
 Smyth & Ryan
- Stone Saws**
 Anderson, Geo.
- Store Fronts**
 Zouri Drawn Metals Co.
- Structural Iron and Steel**
 Canadian Allis-Chalmers, Ltd.
 Canada Steel Company
 Chicago Bridge & Iron Works
 Des Moines Bridge Company
 Dominion Bridge Company
 Hamilton Bridge Works Co.
 Mackinnon Holmes & Co.
 Manitoba Bridge & Iron Works
 Maritime Bridge Company
 McGregor & McIntyre
 Phoenix Bridge & Iron Works
 Reid & Brown
 Sarnia Bridge Company
 Steel Company of Canada
 Structural Steel Company
 Standard Steel Construction Co.
 Walsh Plate & Structural Works
- Submarine Drills**
 Lecky & Collis
- Swinging Gears**
 Dake Engine Company
- Tanks and Stand Pipes**
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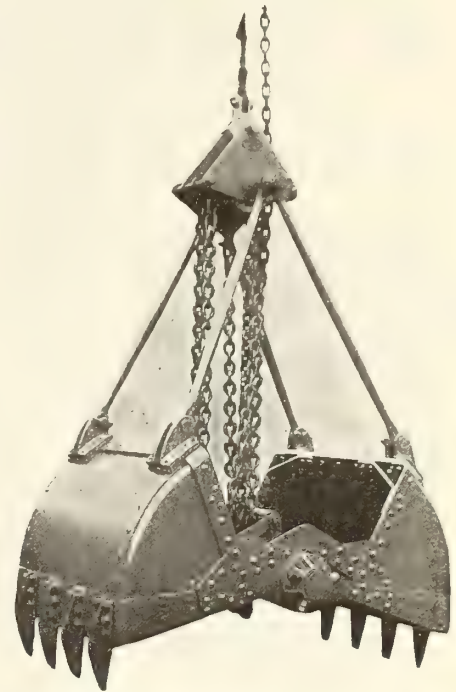
For **free sand, gravel, phosphates, ballast, moist clay or soft earth**, grabs of the type here illustrated may be suitably employed.

The jaws are shallower and have a larger spread when open than those of the grabs for Mud. They are thus able to fill in comparatively dense materials.

Mild steel teeth of T section are riveted to the jaws, as shown in the illustration. The teeth can be made detachable.

The lugs for the four opening and closing levers are placed on the outside of the jaw plates to increase the digging power, and the corners of the jaws are strengthened on the inside with gusset plates.

For estimating purposes, it may be assumed that in **sand and gravel** (with high purchase gear) quantities equal to the flush capacities will be lifted. In **soft moist clay** the contents are usually heaped up to the heaped capacities.



The above is an extract from Priestman's grab catalogue in which grabs for many purposes are fully described and much useful information given. We shall be glad to send you a copy.



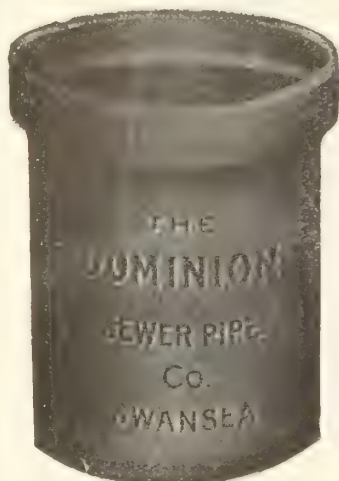
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In our salt glazed vitrified sewer pipe we offer the highest type of sewer material. Pipe of our manufacture have been used in practically every city in Canada. Highly glazed and perfectly vitrified.

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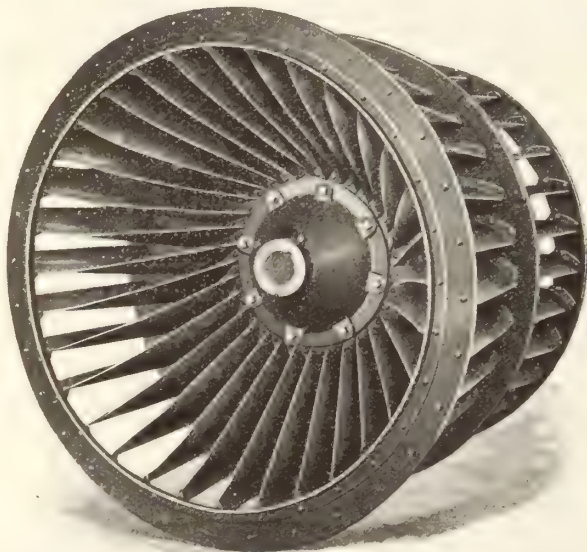
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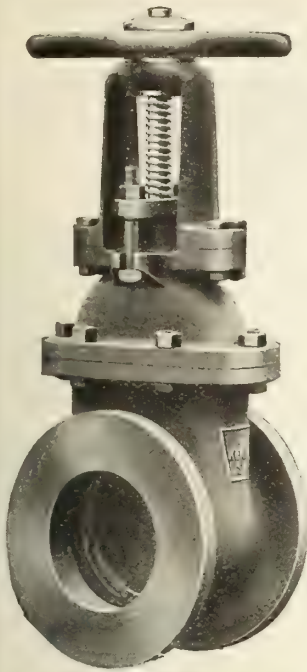
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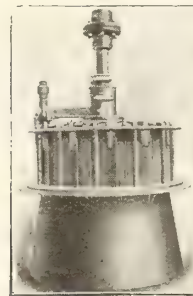
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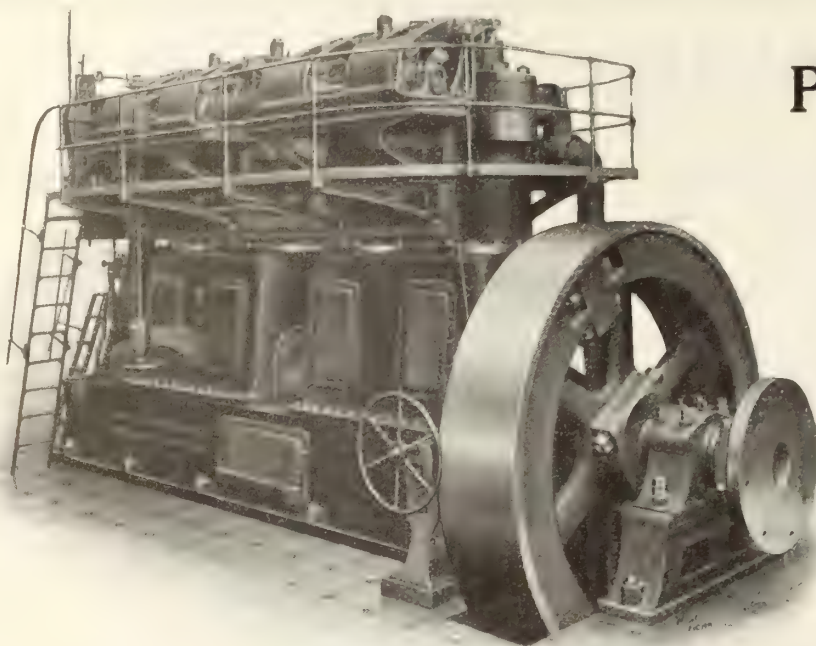
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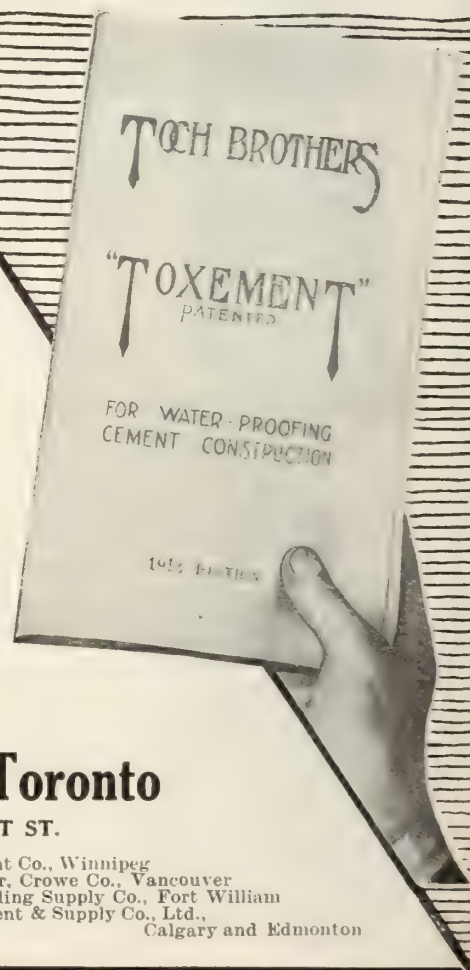
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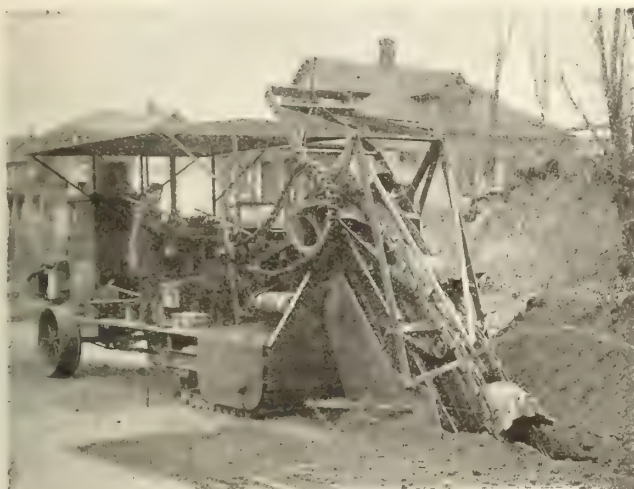
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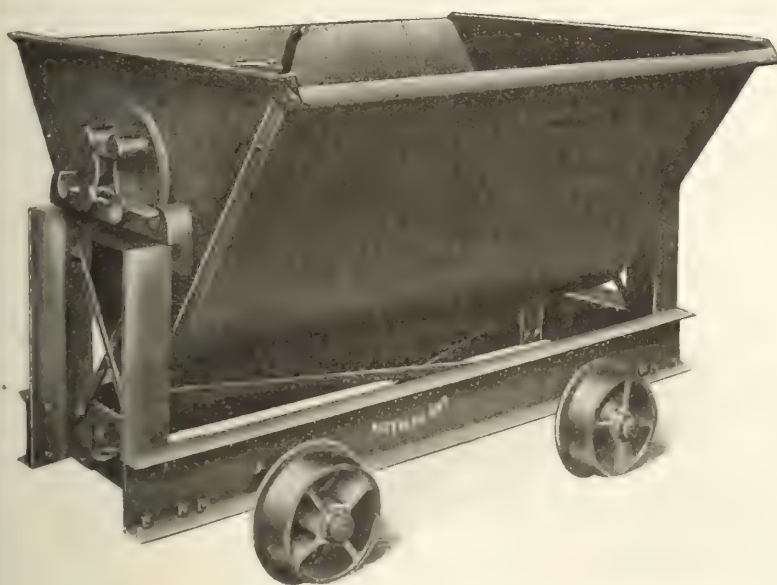
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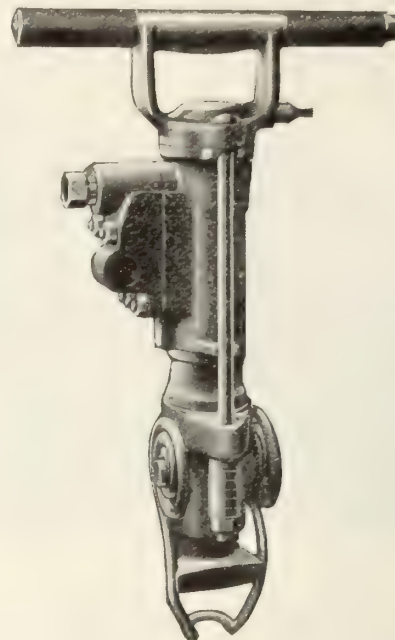
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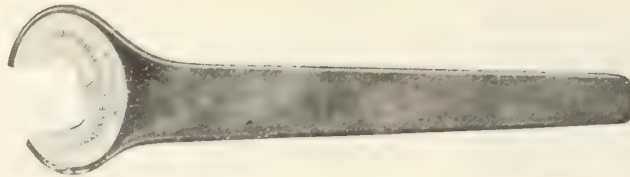
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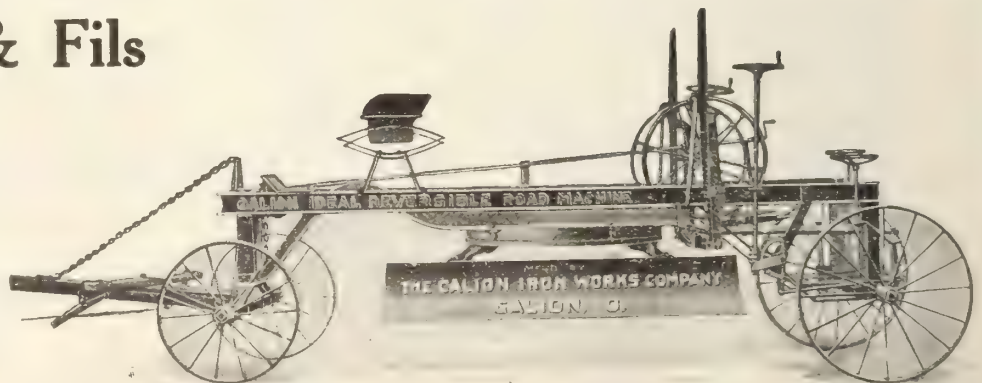
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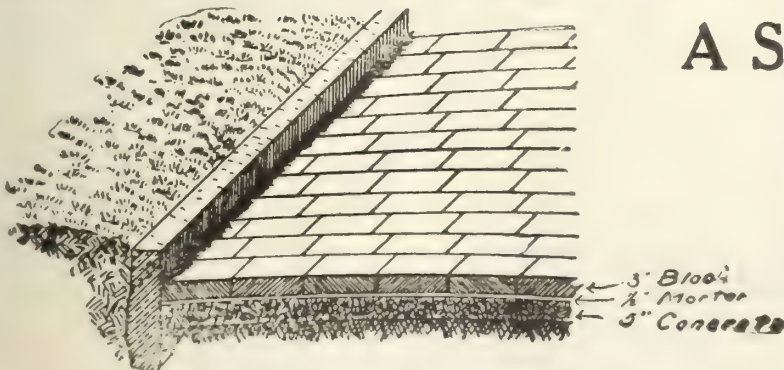
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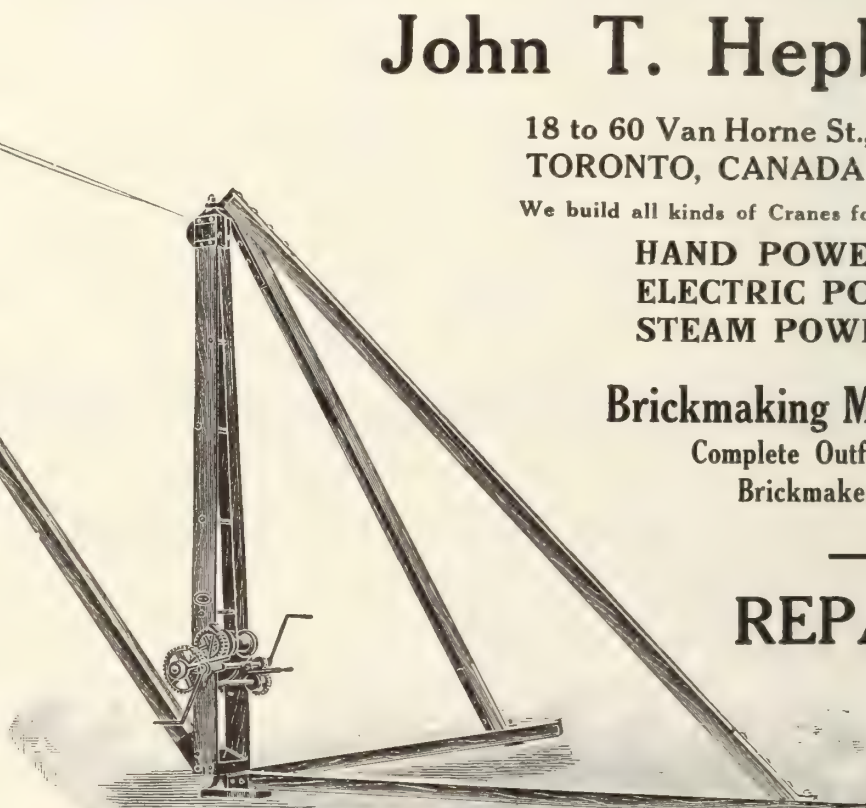
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Contract Record

ESTABLISHED 1886

and Engineering Review

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No. 4

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Is Competitive Bidding a "Lottery"?

ONE of our contracting friends on the other side of the border, who espouses the cause of having quantities furnished to contractors by proper quantity surveyors, humorously suggests that in order to further the end in view, the owners might, as a beginning, be indicted for running a "lottery," which they do when they invite bids on building work, figuring having become so largely a game of chance under existing methods. We must admit that this viewpoint had not presented itself to us before, although we had recognized many defects in the prevailing system. There is certainly room for improvement in methods of estimating and we believe that the introduction of the quantity system would open up a wide avenue of improvement. The idea of the quantity surveyor is certainly gaining in favor in the United States, thanks largely to the efforts put forth by the American Institute of Quantity Surveyors.

At Spokane, Wash., at a meeting of architects and contractors held to consider estimating methods, one of the audience expressed the opinion that Shylock of old was originally a building owner, who had tried, first of all, to get his full pound of flesh out of some contractor, and that the account of him handed down to us in the "Merchant of Venice" was a distorted one. History had repeated itself, for in these days there were owners who would squeeze contractors whenever they got the chance and who preferred not to state frankly and honestly upon how much material they wished bidders to estimate. The speaker contended that the quantity system provided the remedy.

The quantity system of estimating consists in furnishing to each bidder an itemized, detailed copy of all the quantities of materials and labor necessary to construct a building. Against each item each bidder places a unit price, including such profit as he may wish to make. All items are then figured out in dollars and cents and totalled, the result being the amount of the bid.

Vulgarity and Obtrusiveness in a New School of Design

THERE are many ways in which we can emulate the United States to considerable advantage, but architectural practice, generally speaking, is not one of them. We make the point because—for a time, at any rate—the interest of the man in the street has been centred in the so-called "skyscrapers," the latest abomination to which we have been reduced by overcrowding in our cities and encouraging speculators to "boost" the value of restricted areas of property. Our municipal authorities have shown evidence of some enlightenment in this regard of late, but the fact remains that here in Canada it seems preferable to boast that we have the highest building in the British Empire to priding ourselves that we have one which is in the first rank of those famed for the excellence of their design and for the manner in which they exemplify the best principles of sanitation, lighting, heating and ventilating.

The city of Toronto is going wild in its advertisement of the transformation that will be effected at the corner of King and Yonge streets upon the completion of the buildings now in course of construction. But after all, these structures serve but to emphasize the fact that such is the greed of the age that we are ready to build upon the mistakes of others and to perpetrate

fresh mistakes if the financial inducement be of sufficient consideration. Who that has visited Toronto has not had thrust upon him the fearfully congested state of various down-town intersections at busy hours—a constant and growing reminder of the lack of foresight in laying out the city's main thoroughfares. We regard ourselves as a nation of builders and take a pride in the constructional development of our country, but we must see to it that we keep well abreast of really sound principles of design. It is a sign of the times, and one which should provide us with food for a little reflection, that the Japanese are beginning to deride the architectural attainments of the country to the south of us, characterizing them as mere accumulation of building material, possessing no artistic value at all.

"Mere accumulation of building material" may serve the immediate end of enriching the present generation, but it will not provide an inspiration for the next. Unless we strive for artistic creation we shall never rise above the commonplace. Arguments against giving art its proper place in building design proceed only from ignorance. A country without art is like a man without a soul, and there is all too little evidence of art in Canada. Let us hope that the twenty-two storey building upon which operations are just commencing in Toronto will remain the tallest building in the British Empire until the end of our day and generation. These towering structures may have merits in their own "school," and along general lines of design they may survive careful analysis; but the fundamental principles of the skyscraper are vulgarity and obtrusiveness.

Increased Efficiency of Hydraulic Turbines

DEVELOPMENTS in the design of hydraulic turbines during the last ten years were featured in an interesting paper entitled, "Present Practice in the Design and Construction of Hydraulic Turbines," presented by Mr. Birchard Taylor at a meeting of the Mechanical Section of the Canadian Society of Civil Engineers on January 15. The meeting was presided over by Mr. H. H. Vaughan and an interesting discussion followed the reading of the paper. Mr. Taylor observes that hydraulic turbine design has passed through a stage of wonderful development during the last decade, and, in respect to many features, remarkable progress has been made toward bringing the turbine to a higher state of perfection.

As a result of theoretical investigation, substantiated by experimental research of the highest order, efficiencies have been increased on the average about ten per cent. Corrosion of runner vanes, at one time a serious factor as affecting the maintenance of turbines and their efficiencies, has been eliminated subsequent to conclusive demonstration that it is primarily the result of defective design. The development of high specific speed runners, thereby permitting the use of higher rotational speeds, has resulted in the rapid passing away during the past few years of the multi-runner types of turbines in favor of the vertical shaft, single runner type. At one time it was generally thought that the character of speed regulation of a turbine was dependent entirely upon the governor. Today, however, it is known that the make or type of governor has little or nothing to do with speed regulation, except in so far as it must have sufficient power

and proper adjustments to move the turbine gates in a certain time and without hunting.

Ten years ago it was considered a notable achievement to obtain in a turbine in place an efficiency as high as 82 per cent. The average of the best results secured was in the neighborhood of 80 per cent. The maximum guarantee of the builders were from 78 to 80 per cent., and were considered highly satisfactory. During the past two years, efficiencies between 89 and 92 per cent. have been quite common, while a maximum value of 93.7 per cent. has been secured. Today the builder must guarantee an efficiency of at least 87 per cent. in order to secure business.

It is interesting to note that the improvement in turbine efficiency has taken place during the time when the general policy of the power companies toward the builders has changed from one under which a great majority of contracts were awarded to the lowest bidder to the present one under which merit is frequently given first consideration. Under the former policy, business was secured by the builders at such prices as to allow little or no margin between actual cost and selling price. As a majority of turbine installations undertaken ten years ago were unsuccessful at the start, and required alterations or replacements to make them acceptable, the contracts which showed a profit were few and far between. Thus there were frequently no funds available to cover the cost of experimental work by the builder to improve the quality of his product. As the data available ten years ago was by no means reliable, a majority of the builders had very little assurance of the successful outcome of their work. There was, consequently, a very strong incentive on the part of some of the builders to avoid, if possible, the making of any tests which might prove that the apparatus had failed to meet the guarantees. Most of the important contracts are now awarded on a basis of merit, and designs and guarantees are given far more consideration than price. A great amount of work is done on a cost and percentage basis, whereby the builder is guaranteed a profit, contingent on the proper execution of his part of the agreement. The ability of the builder to construct the apparatus in accordance with his designs is now taken into consideration in comparing competitive designs.

A high guarantee of efficiency is no longer satisfactory to the purchaser unless it can be justified by conclusive evidence in the form of reliable data secured from tests on similar apparatus, or in connection with experimental turbines tested by disinterested parties. The builder who, by the presentation of such data, demonstrates that his guarantees will probably be exceeded, is given preference over his competitor who, although he may have made the same guarantee, is unable to prove that he has an equal margin in reserve.

Engineers of power companies are now taking a much greater interest in the experimental work of the builders than previously, frequently volunteering to share in the expense; provided, of course, that such work will be of some aid to them in selecting the best type of apparatus. In some instances, power companies have allowed under contracts certain sums of money to be expended on experimental work to be carried out by the builder. In many contracts for waterwheels placed during the last few years the builders have been required to guarantee the efficiency on a bonus and penalty basis, the rate ranging anywhere from \$1,000 to \$5,000 per unit for each one per cent. of efficiency, the rate in each particular case depending, of course, upon the value of efficiency to the

purchaser. This co-operation on the part of the power companies has been a very important factor in producing the remarkable improvement in efficiency which has been obtained during the past ten years, for it has made possible the expenditure of considerable sums of money to cover the costs of research and experimentation. Another important factor in the rapid strides made in waterwheel design during the past ten years has been the co-operation on the part of consulting hydraulic engineers.

Report of the Civic Survey on the Toronto Works Department

THE Civic Survey Report on the Toronto Works Department has been issued to the public by Mr. Winfred B. Holton, of the New York Bureau of Municipal Research. The entire report comprises about 32,000 words and the portion issued was merely a summary or general statement.

It is pointed out that the survey was undertaken at a time when the entire organization was undergoing many changes. The present administration of the Works Department is highly commended for its initiative and resourcefulness in dealing with reorganization problems.

Summarized, the recommendations are as follows:

(1) Centralization of working forces as an essential to efficient management, specifically by (a) central stenographic division, (b) central permit division, (c) central drafting and surveying force, (d) central inspection force, (e) central payroll division, (f) return to former method of operating street cleaning and garbage collection as section of Department of Works; (2) reduction of stores force; (3) care in seeing that each class of employees is kept to its own kind of work; (4) change of methods of appropriation control by new accounting procedure and administrative practice; (5) revision of contract accounting; (6) installation of adequate system for keeping cost and expense records; (7) establishment of repair fund for outside work; (8) standardization of permit forms; (9) revision of forms and methods in street opening permits; (10) new stores ledgers and periodic audit; (11) introduction of adequate time and service records; (12) revision of report forms; (13) improvement of form and prompt publication of annual report; (14) establishment of general ledger control of subsidiary accounts; (15) provision for prompt payment of department bills; (16) consolidation of Departmental Reference Library with Municipal Reference Library; (17) adoption of plan by which street-cleaning force will make light street repairs; (18) study of relative efficiency of large and small sewer catch basins, with reference to cost of cleaning; (19) greater co-operation between roadway section and street-cleaning department; (20) adoption of definite programme for sidewalk improvement; (21) more intelligent diversion of traffic from streets closed for repairs; (22) citizen backing of Works Department in programme to rid the city of overhead wiring; (23) advisability of department's doing all its own teaming work; (24) sending of notice to property owners affected when street is to be torn up by construction work; (25) putting construction and maintenance of park roads under jurisdiction of Works Department; (26) preparation of complete record of all substructure street conditions; (27) steps to expedite the performance of public works; (28) substitution of unit-cost for "lump-sum" bidding; (29) substitution of city work for present contract system in laying water mains; (30) revision of laws relating to local improvements in order to (a) stop the present practice of charging a part of maintenance against abutting property, (b) avoid the necessity of paying for repaving and reconstruction by local assessments, (c) get away from frontage plan of assess-

ments; (31) adoption of a definite programme for track-allowance pavements, looking to substitution of approved modern construction for present costly and inadequate methods; (32) adoption of a municipal civil service.

The Clay-Workers' Convention

AS announced editorially in our last issue, the Canadian National Clay Products Association are now holding their Twelfth Annual Convention at the King Edward hotel (Tuesday, January 27 to Friday, January 30). In addition to the general discussions and social features, addresses and papers are scheduled to be delivered by the following gentlemen: Mr. Herbert N. Casson, New York City; Professor Orten, Columbus, Ohio; Mr. M. E. Gregory, Corning, N.Y.; Mr. Joseph Keele, Toronto; Professor M. B. Baker, of Kingston, and Professor Day, of Guelph; Dr. M. C. McKay, Principal of the Technical School, Toronto; Mr. John Millar, Clayburn, B.C.; Mr. John F. Wilde, Calgary, Alta.; Mr. Miller Gibson, Waterdown, Ont., and Mr. A. F. Greaves-Walker, Toronto. Many of these gentlemen are in the very front ranks of clay experts and altogether the meeting promises to be of the most interesting of the kind ever held in Canada. Mr. John Millar is a brother of President Chas. A. Millar. Formerly he was manager of the Don Valley Brick Works, but he has been in British Columbia for some years and doubtless he will have much of interest to relate concerning the clay resources and operating methods of the far western province. Professor Orten, of the University of Ohio, will speak on the subject of Ceramic Courses and his remarks will be timely now that arrangements are being made for providing clay-workers with educational facilities in Toronto's new technical school. Professor Day, of Guelph, the tile expert; Mr. Jos. Keele, of the Geological Survey; Professor Baker, of Kingston, and the others are too well-known to require any further introduction at our hands. A report of the meeting will be published in our issue of February 4.

"English as She is Writ"

ENGLISH is a subject deserving of more attention than is given to it by the average engineer. One would think that in an age when slang is tolerated so freely, the engineer, trained in habits of accuracy, would set an example in the use of clear-cut, precise sentences conforming to the fundamental laws of his tongue, but this is true only to a degree: there is still a great deal of room for improvement. Both engineers and contractors must realize that their only effective advertisement is in a lucid description of their work, their style free from ambiguities and other shortcomings. It is in the best interest of us all to aim at a higher standard in this direction, both for ourselves and the next generation. The subject is called to mind by an able editorial in the Financial Times from which we extract the following:

"The English currently used in business correspondence in this country is an unmitigated outrage, not only upon all the canons of literature, but also upon all the dictates of common-sense. It is not for us to condemn it because it is not beautiful—a business letter, to fulfil the purposes of its existence, does not have to be beautiful—we condemn it because it is meaningless, obscure, indefinite, crammed with tech-

nical-sounding but inapplicable phrases, weighted down with clause upon clause so carelessly tacked together that the structure and meaning of the whole are completely invisible. Hundreds and thousands of men of the shrewdest business insight and keenest judgment fail miserably when it becomes necessary to communicate what is in their minds to some other party on a sheet of office notepaper. Half of the tearing up and down the country that fills our Pullman cars and prematurely greys the hair of our commercial magnates is the result of their instinctive distrust of their own ability to explain themselves by correspondence. A vast number of them sketch their ideas vaguely to a trusted stenographer who has a good general idea of the workings of their minds, and leave it to her (or to him) to elaborate the final expression; but such stenographers are hard to get and hard to keep, because the

average stenographer's ignorance of English is second only to that of the average business man.

"There is not sufficient value attached to a knowledge of the English language. One reason for the high average of success attained by newspaper reporters who leave that vocation for commercial or financial careers is the fact that they have been engaged for a time at least in the one business in the country in which the use of English (poor it may be, but still English) is an essential function. For a year or two they have been obliged to express ideas in intelligible words. We hope some day to see the art of expression restored to its proper place as one of the prime essentials of a business education. By that time, of course, a "business education" will be something entirely different from the preposterous cramming with crude technical facts which now usually passes under the appellation."

Engineering Topics in the Old Land

A Discussion of England's Social Problem Which Reveals the Relatively Stable Character of Canadian Development

By Our London Correspondent

SIGNS are not wanting of the awakening of the Old Country to the fact that her status in the world's markets is seriously threatened. Two keels to one—or twenty to one for the matter of that—is a secondary matter in comparison with efficiency of production. Self-preservation is the operating motive in both cases, but while efficiency of production is necessary for the keels, the reverse does not necessarily follow. In any consideration of the question three primary factors enter, and we purpose dismissing in as few words as possible at least two of them. Efficiency of design and modern methods of production (the two may be taken as one and indivisible) is the first of these, and while we think that the productions of the Old Country compare favorably with those of other nations so far as design goes, we feel that sound business methods are only too often woefully lacking. Standardisation, too, which is quite a feature of Continental work, might be studied with advantage. Extension of her markets is the other of these factors, and here the Old Country is far behind her rivals on the Continent. A limited market means restricted output, with consequent high cost of production. The larger the field that can be covered, the greater the possibilities. To live merely in the present is, in things commercial, to live in a fool's paradise. An eye and a half must ever be on the future, and foreign firms recognise this to the full, as witness the undeniable fact that their representatives are to be found in every corner of the habitable globe. *Ce n'est que le premier pas que coûte*—it is the first step that is the most difficult—and, as even the humblest drummer knows, a footing once gained the rest is comparatively a walk-over.

Co-operation Between Capital and Labour

We come now to the third of our factors, due co-operation between capital and labour, and almost insuperable difficulties at once present themselves. Capital is after all only stored-up labour. Capital cannot be self-created. Plant it in a soil ever so favourable to germination and not a bud or a tendril will be raised in a million aeons. Labour, and labour alone, can fer-

tilize it, and under the fostering care of labour there is no limit to its growth. And the converse applies, to a lesser degree, to labour. Without capital—in the form of tools, plant, power, food and clothing—labour in a civilized community is valueless. Fruit is not to be had in towns for the plucking, and the most persistent rearing of flocks would fail to supply any but quite a small proportion of a nation, owing, among other things, to the difficulties attending transport. Primeval conditions can no longer obtain, in short, and it would be waste of time further to dwell upon them.

In a country such as Canada, a man has possibilities. His horizon is, so to speak, unlimited, and he may reap at least a welcome proportion of what he sows. Even in the worst-paid occupations, his wage is a living one, and the rewards of agriculture are not limited to rheumatics and the union workhouse. That there will be out-of-works and work-shys is one of the regrettable features of advanced civilization, but it must be remembered, as a set-off against this, that famine, rapine and bloodshed are practically extinct. Turning to the Old Country, we find that a large proportion of the population is in a state of chronic or partial starvation. There are tens of thousands of families that stolidly and heroically face the fact, from year to year, their life through. The casual labourer is of the type, and gaunt suffering may be traced in every line of his face, tragedy in his sunken cheek and hollow eye. Even the skilled worker does not escape, and in many trades work is uncertain and insecure, while wages are the lowest that can keep body and soul together. A week's unemployment spells discomfort, a month's unemployment disaster. Strikes and lock-outs have been a distinctive feature of the year that is past, and in the year that is with us the very gravest trouble is likely to occur. There is no blinking the fact that the English worker has got the bit between his teeth and he is racing both himself and his employer fast to perdition. That things are unequal cannot be gainsaid. Vast wealth on the one hand and bitter poverty on the other betray callousness of a most reprehensible nature. Mansions lie cheek by jowl with hovels, and wanton

waste forms the necessary complement of woeful want. Shoemakers are shoeless, clothing hands naked, food producers starving; with plenty there is famine, with redundancy want; and none can see a way out of the infernal tangle which is sapping the strength and resources of the nation.

Due co-operation! In that alone lies the solution of a problem which yearly grows more and more acute. The small manufacturer, the single (as against the multiple) shopkeeper, the home worker—all are at their wit's ends how to bring about the meeting of ends. To pay a worker more is beyond their power. There may be the will, but the deed is undoable. Foreign competition is too strong, with its low wages and the lower standard of living of the workers. Profits, too, increase numerically as time goes on, and goods will pass through half-a-dozen hands before they reach the consumer, and at every change a profit will be expected. Steadily, too, the octopus companies are spreading their tentacles, embracing all, regardless of all. Small businesses are going to decay and large ones are threatened. Trusts rule the market, and the man who attempts to beard them is starved out. The actual worker simply doesn't count. He is a necessary evil, the sport of fortune, and is cast aside when his limbs lose their suppleness and his muscles their vigour. The apprenticeship system is dead, and the reaction inevitable in the transition from a state of ignorance to one of so-called education is yet keenly felt. The lower forms of unskilled labour attract both sexes, not simply because they are easier but because a wage may be obtained at once and a few shillings added thereby to the family coffer. Employers raise the cry that they cannot obtain the skilled labour that they require, oblivious of the fact that they are by their very methods crushing any possibility of supply.

Radical Changes Necessary

What supremacy the Old Country has in the world's markets at the present time is, we are much afraid, on the decline, and radical changes alone can conserve that which still remains to her. Obsolete methods must go by the board, and the push and enterprise of the younger nations must be adopted. The workers, and especially those of the rising generation, must be given a fair reward for their labour, and they must have some security against evil times and old age. To ask a man on a bare living wage to provide against unemployment, sickness and old age is to ask the impossible. The multiple traders, the ground landlords, the non-producing landowners must forego some of their profits, and to the small man must be restored as far as possible what was once his. Foreign competition is too keen to permit a continuance of present conditions, but while the capitalist must rest content with smaller profits the worker must put his shoulder to the wheel and cease from disorganising the machinery of commerce by demands which cannot be met without risk of national bankruptcy. Only by working harmoniously and whole-heartedly together can efficiency of production be obtained. Greed on the one hand and stubbornness on the other are a fatal combination. Malignant growths of long standing call for the knife of the surgeon. In sharp and swift remedy lies the only hope of cure, and the Old Country has been sick for many years. We can but wish her a speedy and full recovery!

In depositing concrete in deep water through a funnel the most difficult part of the operation, says the *Engineering Record*, is filling the tube at the start. As

is well known, unless the tube is sealed in some way the cement will wash out during the downward passage and leave only a pile of stone and sand. This waste of concrete may in the case of a 12-in. tube 50 ft. long amount to more than 1 cubic yard. A simple but effective method of preventing this waste was described at a recent meeting of the American Railway Bridge and Building Association at Montreal. A 7-in. or 8-in. layer of wood shavings is first inserted and is covered with about 1-in. of cement. This forms a plug, and as the concrete is dumped on top the buoyancy of the plug and resistance of the column of water underneath prevent the first concrete from falling rapidly enough to wash out the cement; from then on the concrete itself serves as a seal.

Bush-Hammering to Relieve Concrete Surfaces

THE effect of bush-hammering a concrete surface is well illustrated in the factory of the Wabash Screen Door Company, at Minneapolis, Minn. No attempt was made to obtain an especially artistic structure, but rather, one of maximum utility and permanence, so that huge window areas predominate with concrete spandrels at each floor level, set back a few inches from the concrete beams and columns. The design is strictly utilitarian, yet susceptible to treatment to bring out a measure of architectural fitness, if not actual beauty. The treatment consisted of bush hammering all surfaces, except bands which were left plain for contrast. The roughened concrete with some color exposed in the coarse aggregate, combined with the smooth untouched surfaces, and the play of light and shade due to the shallow reveals, has imparted a distinctly pleasing effect, which is noticeable both at a distance and at close range.

The concrete is a 1:2½:3½ mixture using crushed blue limestone and was placed in ordinary forms. After thorough hardening it was bush hammered from a suspended platform, the edges being protected by strips of wood. The cost was about eight cents per square foot, rather a high figure but occasioned by the many small and narrow surfaces. Five to six cents is a usual figure.

Bush hammering has still greater possibilities, in that different colored aggregates may be used in panels and columns, the process adding contrasts of color to the rich texture. Black and red granites and feldspars, colored marbles and other aggregates not commonly used offer every possible color range and should open up a wide field for architectural expression. To embody such decorative features in the structural frame, integral with the necessary elements of the building is the most practical and fundamentally logical means of decoration and far more correct in principle than the application of veneer which has no structural meaning.

To combine the strength and permanence of concrete with the beauty of natural stone, in a monolith, is approaching the ideals of the Greek builders who countenanced no shams, using marble in solid blocks and only in shapes which the structural design demanded. The architect of to-day has all the natural stones at his command and an ideal matrix into which they may be incorporated—concrete. This same matrix is an ideal construction material, suitable for residence, factory, office building or garden wall. Such a construction has the added advantage of comparatively low cost, which makes such decorative work possible in factories as well as in the higher forms of construction.

The Beautifying of Highway Bridges

Increased Attention Given to this Subject following Activity in Road Work in Recent Years—Hints on Aesthetic Bridge Design

By Henry Grattan Tyrrell, Consulting Engineer, Chicago

HIGHWAY bridges, even in the rural districts, are coming to have a greater claim on public attention, owing to the general impetus in road-building and extension. In the following paragraphs some rules are therefore given as a guidance in aesthetic bridge design, most of them being based on Tyrrell's Artistic Bridge Design, and Tyrrell's History of Bridge Engineering.

Taste for the beautiful depends on environment, and the character, culture and education of a people are frequently revealed in their constructions. Those who live in primitive and rustic surroundings usually have their aesthetic taste less highly developed than their more favoured brothers in the vicinity of educational centres. Unfortunately, fashion often influences in constructive matters as in other things, and the prevailing fashion in bridge building, in America at least, is the unsightly framed truss with gaunt and awkward outline. This type is fortunately no longer necessary, for certain rules of aesthetic design have recently been developed and established which but few engineers have yet had the time or the inclination to investigate. Their application to steel framing has heretofore received little attention in America.

The blending of different materials in a single structure is often difficult, but in the little park bridge at Madison, N.J., designed by the writer a few years ago, the blending was so arranged that the general effect is harmonious. The centre span is a steel arch, while the abutments are rough-faced stone work and the steps concrete. It is located in a city park over two lines of railway and is surrounded with plants and shrubs, making the effect quite pleasing.



Curved wing walls and balustrades with terminal ornaments would have greatly improved this design.

The condition and character of bridges, roads and other public utilities have been measures of civilization in all ages. The homeless savage in trackless wilds had little need for bridges, as his wants were few and achievements small. But as civilization dawned, human needs increased and the desire for greater comforts, better homes and surroundings,



Pontoon bridge over the Rhine at Cologne. More attractive than an unsightly one of steel.

created a need for transportation and communication. The bridge of fallen logs or swinging vines gave place to better and more commodious ones over which loaded animals and carts could pass in safety. With the further advance of civilization and the extension of commerce, heavier and better bridges were required until the coming of railroad transportation in the nineteenth century, when stronger ones were erected to carry trains of cars and locomotives. The earliest bridges, like houses and other structures, were for utility only, and little or no thought was given to their adornment. Primitive races were content with homes which merely sheltered them from the storm and with rude bridges which served only their barest needs, but succeeding generations produced buildings in which utility was combined with art. But while houses have been adorned and made architecturally attractive, the beautifying of bridges has not advanced in proportion to other arts. Many cities which have splendid buildings, streets and parks, are disfigured with utilitarian bridges, wholly void of art and worthy of existence only in remote regions. The



Bridge at entrance to Como Park, St. Paul.



Bridge in Golden Gate Park, San Francisco. The view shows the ornamental balustrades.



A two span concrete bridge with ornamental balustrade.

greatest lack of art in bridges is found in America and other new countries where the need of rapid construction has prevented aesthetic treatment.

Great bridges are a distinctive feature of modern cities, and according as they are attractive or not they influence public estimation of the place where they are located. The beautiful bridges of Paris, Berlin and Budapest are of enough interest in themselves to attract travellers to those cities, and the bridges over the Rhine are among the principal features of the region. The bridges of these cities, and others, such as New York and London, are more conspicuous, especially from the water, than all their great buildings which have cost untold millions.

The founding and building of empires has always been dependent on roads and bridges. The Romans saw that the requisites for a great nation were a fertile soil, natural resources and abundant means of transportation, and the excellence of the Roman roads has scarcely been surpassed. Their roads and bridges have endured for more than twenty centuries and are used by the present generation. The building of roads and bridges, therefore, has been the greatest factor in the development of nations and empires, and the condition of these utilities has always been a measure of their civilization and greatness.

Bridges are frequently the most conspicuous objects in the landscape. Unlike buildings in crowded city squares, which are partly concealed by their surroundings, a bridge can often be seen for a great distance. The greatest injustice to public taste or feeling is the building of an ugly bridge, for the most prominent and useful structure should be the most beautiful, and yet the reverse is too often the custom. City halls,

post offices, and other public buildings have been adorned, and bridges have been neglected. A city should realize that it is as important to beautify its bridges as its court-house or city hall. Great terminal depots are often erected in the cities and beautiful though smaller ones at suburban stations, while adjoining bridges, which are often more conspicuous than the depots, are left utterly unadorned.

Bridges should be made ornamental because their form and location are so frequently inviting for artistic treatment. The curved lines of the arch and suspension are in themselves attractive and may be further beautified without much effort. It is easy, therefore, to make a bridge one of the most beautiful and interesting features in a landscape. No structures show more clearly their object and use, and the opportunity is therefore offered for truthful construction, a prime requisite for good design.

Bridges, and especially high ones, are naturally impressive, and no objects in a landscape are longer remembered. Returning travellers often retain the memory of a bridge long after monumental buildings have been forgotten.

Bridges should be made beautiful, because people delight to congregate and loiter there, particularly in the summer time. For this reason a bridge is especially suitable for a memorial structure, as it can be appreciated and admired during leisure hours. Bridges should



A common form of public disfigurement inflicted upon communities by the railroads.



A concrete arch with too flat a rise. The metal balustrade gives it a very light appearance.



A bridge with cambered and curved wing walls.



Old covered bridge at Grand Rapids, Mich. A type which generally outlived those of steel.



Pontoon bridge at Weed street, Chicago. Disfigurements of this kind may still be seen in many of our cities.



Bridge at Coalbrookdale, England. The first iron bridge ever built. More attractive in appearance than many modern ones.



Bridge at Reno, Nevada. Three spans would have looked better.



A bridge at Pasadena, Cal., with ornamental features at the ends. Photo made during repairs.

be beautiful because the presence of ornamental structures enhances the value of the surrounding property. City officials who have the expenditure of public money should realize the economy of building artistically in and around large centres of population, for money thus spent is frequently a good investment. Fine bridges give a distinctive feature to a city. Those in

France and Germany, and some few in America, show possibilities in artistic steel construction. The thirty-two bridges over the Seine at Paris are in most cases models of elegance, standing out in sharp and charming contrast to those in some American cities. But the time for better ones is at hand. Utilitarian bridges, which were excusable in the early days of this continent, should no longer be tolerated. The wealth and commerce of America have so greatly increased that the uncouth forms of past generations are no longer permissible as representative works of a great nation.

Some of the reasons for lack of beauty in American bridges may be stated as follows:

(1) Little or no literature on artistic design has been available and no instruction on the subject has been given in engineering schools. Ugly designs, therefore, are often made, when beautiful ones would cost no more. After selecting a form which is far from the proper one, many engineers are accustomed to compute the stresses in the various parts, even to decimals, when the assumptions may never be realized within one hundred per cent.

(2) Commercialism and competition are responsible to a great extent for a lack of art in American bridges, for as a general rule the cheapest bridge, and consequently the plainest one, is usually accepted, and ornamental designs at greater cost are discarded. Ugly designs are usually prepared by contractors' engineers, whose only motive, frequently, is their personal gain.

(3) Hasty construction is perhaps responsible for more ugly bridges than any other cause. New districts have been opened up by projecting long lines of railroad across the continent, the rapid completion of which has often been dependent on the bridges over which work trains and supplies could pass, and hasty construction has often been imperative.

(4) The American railroad bridge with simple



Foot bridge, Garfield Park, Chicago.



An attractive design for a park bridge. Photo taken before completion.

trusses which could be built quickly became the prototype for town and city bridges, and these ugly structures may now be found not only in the country districts but also in and around important cities.

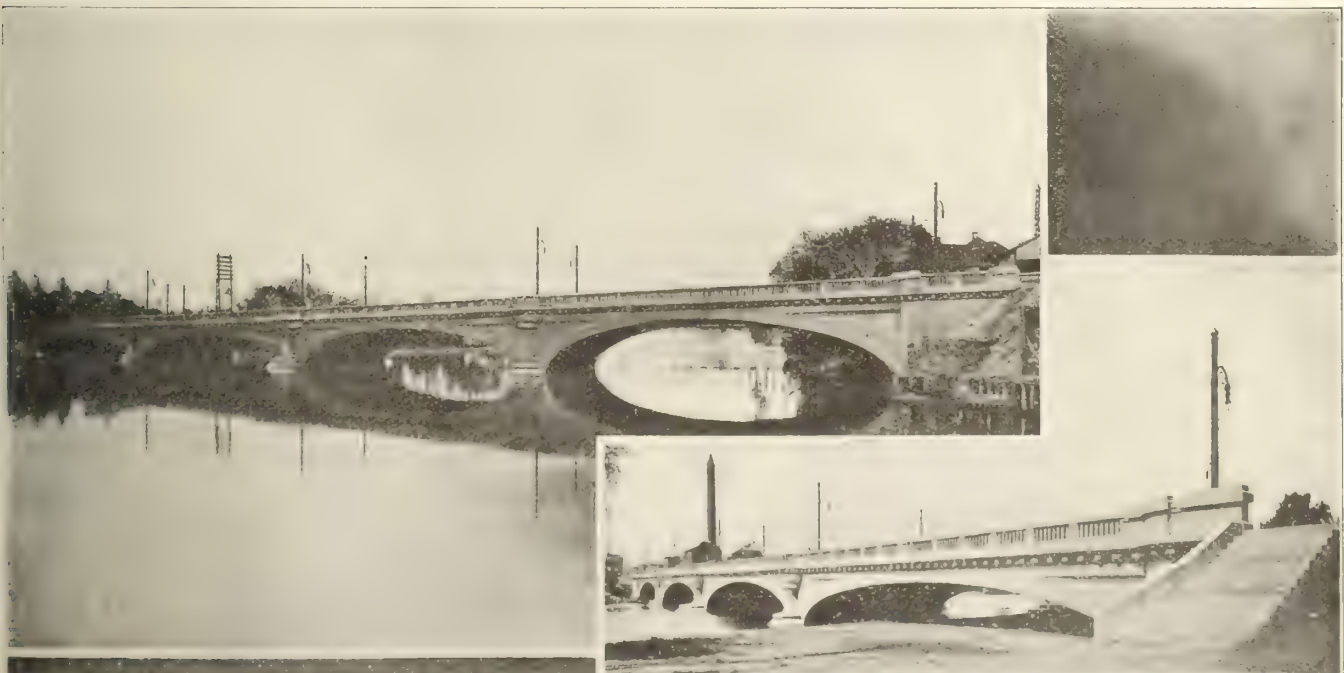
(5) A common excuse for unsightly city bridges is that of insufficient funds or appropriation. This plea is usually without foundation, because cities which spend millions on their public buildings could better afford to beautify their bridges, which are often much more conspicuous.

Bridges have had many uses in addition to forming a passage-way for travel, and ancient ones were frequently lined with shops, or used as a gathering place

for citizens. Old London bridge, and others at Florence and Venice were roofed over, and provided with stalls or shops for merchandise. Others had memorial arches, chapels, or fortification towers at the ends, an American example of great merit being the memorial bridge at Hartford, Conn., standing in Capitol Park.

Statuary is a common adornment on the bridges of Paris, Berlin and other European capitals, but features of this kind are noticeably absent in America, only very few containing anything more than simple structural requirements.

When the writer was asked some years ago by the authorities of Copenhagen, St. Petersburg and Sydney



Jefferson Avenue bridge, South Bend, Ind. A very attractive design, though restricted with small arch rise.

to prepare designs for bridges in those cities, the invitations were declined with great reluctance because of the opportunity for artistic design which is usually acceptable in the capitals of foreign countries. In this connection it is interesting to note that the accepted design for at least one of the bridges—that over the Neva at St. Petersburg, Russia—was the work of an American engineer.

Replacing a Three-Span Cantilever Bridge in British Columbia by an Independent Span

ELIMINATION of falsework was the constructional feature in replacing an old 315-ft. bridge span over the Fraser River on the line of the Canadian Pacific Railway, 150 miles east of Vancouver, B.C. The end spans were supported during erection on the old structure and afterward served as anchor spans to counterbalance the main span during its cantilever erection. Erection adjustments of the center panel were made by screw toggles.

The railway follows up the north bank of the river until the canyon swings around toward the north to such an extent that a crossing becomes necessary. The bridge site selected by the locating engineer in 183 has proved to be well adapted for a crossing, as it is one of the narrowest places on the river and has the advantages of giving a good alignment and solid rock foundations.

The original cantilever bridge was erected in 1883-84, the piers being placed close to shore, giving a main span of 315 feet. This location of the piers made it possible to use anchor spans 105 ft. in length, running from the piers to stone abutments, and two cantilever arms and a suspended span—all three of which being 105 ft. long. Thus the bridge had a total length of 525 ft. between abutments. The structure has been in constant use from the day of its completion in 1884 until 1910, when the use of heavier engines and rolling stock made a change necessary.

The old site was considered the most suitable for the location of the new bridge, and it was decided to erect here three through trusses, using the same masonry, with some slight additions, which supported the old bridge. The two short end spans were erected first, using the anchor arms of the cantilever as falsework. The 315-ft. through span was then erected by weighting down the short spans (specially designed for this stress) with old rails and connecting the top chords of adjacent spans by means of a temporary toggle joint which linked up the steelwork so as to employ the cantilever principle during erection.

Four toggle joints were required, each consisting of eight $1\frac{1}{2}$ x 6-in. eyebars connected to steel pins in the end posts and at the center, as shown in one of the illustrations. Four pins were used at the center, each pair being carried in a frame in which was fastened a nut engaging a thread on a vertical shaft operated by a bull-wheel. By turning this wheel the angle of the toggle joint could be changed at will and the span under construction lowered gradually into place from both ends until the two parts met in the center and were coupled up. The maximum weight of rails put on each short span was about 400 tons.

During the course of erection the traffic averaged from eight to ten trains per day, and was maintained without any delays. After the new bridge was completed and ready for service the old bridge was taken out, piece by piece, and utilized on the Esquimalt &

Nanaimo Railway, a Vancouver Island branch of the Canadian Pacific Railway, on which lighter rolling stock is used. The piers which were used for both the old and new bridges over the Fraser River are about 82 feet high and are founded on solid rock exposed on the shores of the stream. The difference between low and flood level of the river under the bridge is 67 feet, the lowest water record being 125 feet and the flood 58 feet below the deck.

The cost of the original bridge, including masonry and steel, was approximately \$270,000, and the cost of replacing the steelwork is estimated at \$160,000. The new bridge was fabricated by the Canadian Bridge Company according to designs prepared by Mr. C. N. Monsarrat, engineer of bridges for the Canadian Pacific Railway. Mr. C. E. Cartwright was division engineer, succeeded by Mr. H. Rindal, and Mr. H. B. Walkem, resident engineer, was succeeded by Mr. F. P. Wilson.—Engineering Record.

Experiments in Waterproof Concrete

ASERIES of tests to determine the rate and the amount of flow of water through concrete is being made by the College of Engineering of the University of Wisconsin, Madison, Wis., with the object of finding a simpler means of making concrete watertight. Some interesting results have already been secured in the effect of the length of the time of mixing in a machine mixer of the batch type; the effect of the percentage of water upon the imperviousness of the concrete; the effect of having sand in dry condition before mixing; and the effect of having the sand wet.

It has been found that good results are obtained if the concrete remains in the mixer from two min. to three min. when dry materials are employed. For cases in which the sand and gravel or stone are damp a considerably longer time is required. Therefore the use of wet sand should be avoided if possible. The experiments show that 1:1½:3 mixtures consisting of cement, Janesville sand of the torpedo grade, and Janesville gravel, when mixed to a wet consistency, are impervious to water when subjected to a pressure of 40 lbs. per sq. in. Mixtures as lean as 1:6, using a graded gravel, have been made impervious at high pressures by using care in proportioning the amount of water and in mixing the batch.

The specimens used in making these tests are cylindrical in form and so made that the faces of the cylinders, which are 13½ in. in diameter, are exposed to the pre-determined water pressure. The thickness of the concrete through which the water must pass can be varied from 4 in. to 18 in. Ample provision is made for cleaning both faces of the cylinder before placing it upon the testing apparatus. The apparatus itself is so arranged that very accurate tests can be made.

The importance of these experiments will be more sufficiently appreciated when it is understood that a large proportion of the trouble arising from poor concrete is due to the use of defective sand or gravel.

The nuisance of speakers at technical and scientific meetings exceeding the time limit was obviated in an ingenious manner at a recent conference on safety and sanitation in New York. By means of an electric fixture on the president's desk a green light was displayed two minutes before the end of the allotted period of ten minutes, and a red light at the end of ten minutes. The speakers did not exceed their time.

Substructure Work for the Canadian Pacific Railway Bridge at Mud Lake, Ont.

THE Canadian Pacific Railway is building a low grade freight line between Toronto and Perth, Ont. The building of this railway requires the construction of a bridge across Mud Lake, about 150 miles northeast of Toronto. This bridge will consist of two main deck truss spans of 241 ft. 7 ins., and several shorter approach spans. Figure 1 shows an elevation of the structure and indicates the character of the subsoil. The total length of the bridge between the abutment parapet walls is 953 ft. 7½ ins. The superstructure is supported on four concrete piers, two steel towers and concrete abutments. The foundation work was especially difficult owing to the soft character of the subsoil and to the depth of bed-rock.

Description of Site and Subsoil

The geological conditions at the site of Mud Lake are interesting. The lake is surrounded on three sides by high hills and derives its name from the semi-liquid mass, extending almost from the surface of the water to hard-pan, which lies about 86 ft. below the surface at the lowest point (at pier No. 2). Although the route through the lake presented difficult foundation problems, it was chosen in preference to an alternative location among the surrounding granite hills, chiefly because it gave much lower grades. The site of the bridge is about six miles from the railway station, which required that the entire plant and all supplies be transported by wagons over the hilly country.

Construction Equipment

The main plant comprised three 90 h.p. Loco boilers weighing about 20 tons each, two air compressors of about the same weight, a 1-cu. yd. concrete mixer, a stone crusher, derricks, a narrow-gauge working track and cars, quarters for the men, a hospital lock, etc. The sand for the concrete was obtained from a pit about two miles from the bridge site and was delivered in wagons. The stone was quarried from the granite hills and was crushed at the site. The concrete mixing plant was located at the west end of the bridge, the concrete being hauled in dump buckets on cars over a narrow-gauge track. This track was supported on a pile trestle, built across the lake. The materials were handled with stiff-leg derricks.

Construction of Caissons and Piers

Preparations were started on January 13, 1913, for the construction of the foundations of the bridge, and work was actively started in March, 1913, of which operations were continued night and day until about

the first of August. The sinking of the caissons under air pressure presented difficulties on account of the low resistance of the subsoil, both in friction and in compression. In density, the mass could well be classified as soft, blue clay.

Three of the four piers, Nos. 2, 3 and 4 (see Fig. 1 for location) were sunk under air pressure; No. 2 to a depth of 103 ft. 4 in.; No. 3 to a depth of 59 ft., and No. 4 to a depth of 40 ft. below the surface of the lake.

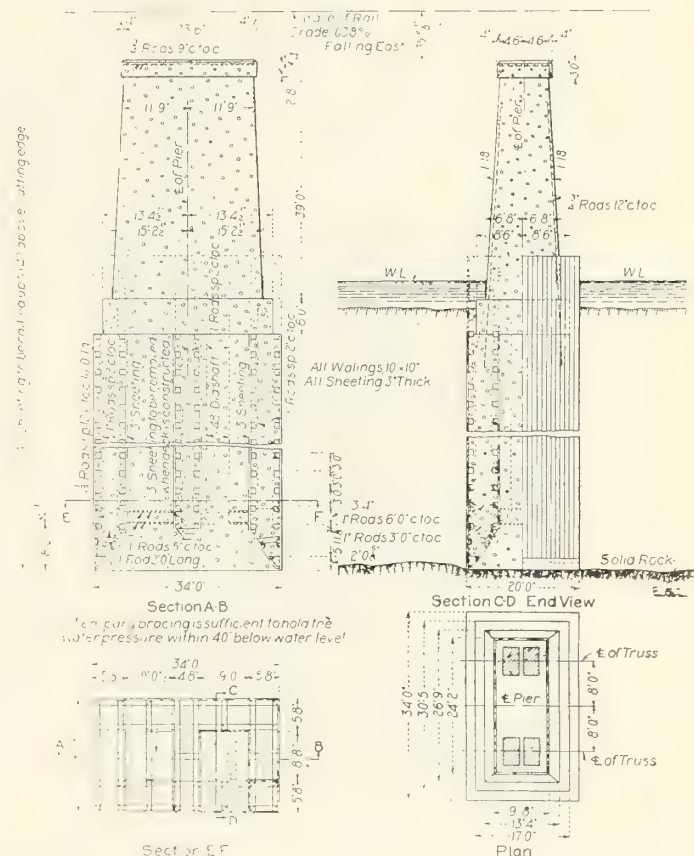


Fig 2 —Plan and sections of caisson and dimensions of pier No. 2.

Except for the lower 13 ft., which consisted of quick-sand and boulders running into hard-pan, the displaced materials were liquid muck and soft blue clay (see Fig. 1). The foundations for pier No. 1 and for pedestals Nos. 5, 6, 7 and 8 were sunk in open cofferdams, constructed of sheet piling.

The caisson for pier No. 2, which required the deepest foundation, was 34 x 20 ft., outside dimensions, and

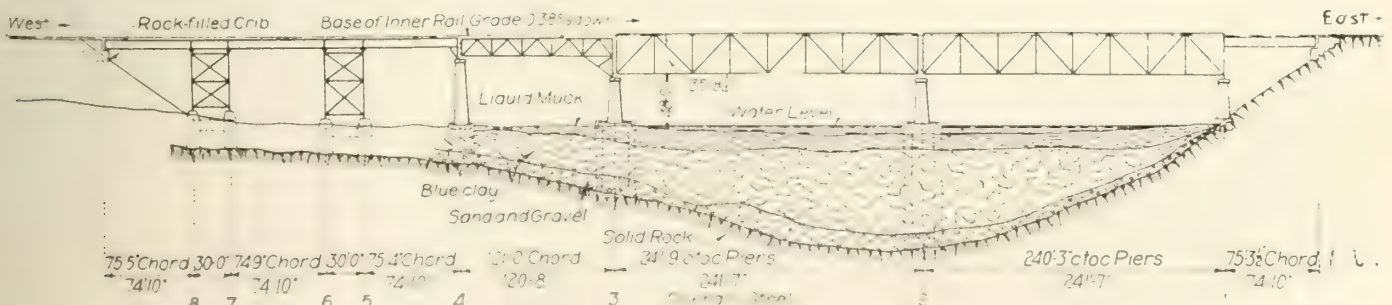


Fig. 1.—Elevation of bridge over Mud Lake, Ont., showing type of construction and character of subsoil.

was provided with two dredging compartments, each 8 ft. 8 in. x 9 ft., inside dimensions. Fig. 2 shows a plan of this pier, its foundation being constructed of 1:3:5 concrete and the pier proper of 1:2:4 concrete. The drawing shows the general features of the pier and the construction details of the caisson. Owing to the softness of the subsoil and to the necessity for a quick sinking of the caissons, they were braced and sheeted like an ordinary wooden cofferdam with a steel cutting edge, the walls of the working chambers being reinforced with rods, as shown in Fig. 2. The work of sinking the caissons was carried on continuously day and night, as no forms were required. After the caissons were dredged to a depth of 40 ft., it was decided to place the reinforced concrete dock. A view, looking west, of the caisson for pier No. 2 is shown in Fig. 3. This view shows the method of excavating the material and also shows a portion of the working track. The shafting for the deck of the caisson was embedded in the concrete and was carried to a point above the water level, on top of which was placed the air lock. The concrete for the deck was placed under water, even though it was accomplished with considerable diffi-



Fig. 3.—View of caisson No. 2, looking east.

culty, the remaining 63 ft. being sunk under air pressure. The maximum pressure required for the sinking of pier No. 2 was 47 lbs. per square inch. Great care was exercised in choosing men for this work, and only those who had previous experience on caisson work were engaged. The length of time which the men worked under the maximum air pressure was 45 minutes. A hospital lock was installed at Mud Lake, and those afflicted with "bends" during the sinking of the caissons were at once treated by the usual air method.

The caisson for pier No. 3 was of the same size, except that the depth was much less, and the methods used for sinking it were similar to those just described. Pier No. 3, above the caisson, has the same dimensions as pier No. 2.

The work was carried on under the direction of Mr. C. W. P. Ramsay, engineer of construction, from the design of Mr. P. B. Motley, engineer of bridges for the Canadian Pacific Railway. The foundations were constructed by The Foundation Company, Limited, Montreal and Vancouver, Mr. A. I. Campbell, superintendent.—Engineering and Contracting.

Use and Cost of Concrete Pedestal Piles

IN a thesis submitted for the degree of B.Sc. at the Georgia School of Technology, Atlanta, Ga., Walter Grady Miller presents a comprehensive report on the foundation for the Fulton County Courthouse, Atlanta. After discussing the general features of the building, the nature of the sub-soil, etc., he describes in detail the pile foundation.

The essential duty of the pile, according to the thesis, is to transmit a certain load which cannot be carried by spread footings on account of unreliable ground, to the firmer and more reliable sub-soil. It performs this duty by its direct bearing on the sub-soil under its base, and by the friction of its surface with the soil penetrated.

In the first case, the pile acts as a column loaded at the top by the footing, and transmitting its load to the firmer sub-soil at its base; in the second, the frictional resistance is transmitted to the sub-soil by a conoid of pressure. If the intermediate soil between the upper and the lower end of the pile happens to be a very soft clay or quicksand, the frictional resistance will be greatly reduced, and the load carried will depend chiefly on the bearing area developed by the base of the pile. It is thus seen that the pile with an enlarged base is in many cases a necessity while in many cases it is from certain points of view advantageous to use such a pile.

The Work at Atlanta

The successful bidder for the pile foundations on the work described was the MacArthur Concrete Pile & Foundation Company, which has developed in the last few years the pedestal pile. The essential feature of this pile is an enlarged base. In constructing this pile a heavy cylindrical casing is driven to the required depth, usually to refusal under a specified number of blows of definite weight. A batch of concrete is then placed in the hollow cylinder, to be followed by a rammer. The cylinder is raised a little and the rammer is driven downward, enlarging the base of the pile into a bulb or pedestal. This process is continued until a base of required size is developed, after which the vertical pile is completed by filling the cylinder with concrete and gradually withdrawing the casing.

One advantage of the enlarged base pile over the ordinary taper pile lies in the fact that the latter has a tendency to be "driven down" as a post with a sharpened end drives much more easily than one with a blunt end. An enlarged base pile, on the other hand, strongly resists any "driving down" action.

Methods Used in Pile Driving

The pile driver used on the Atlanta work consisted essentially of a steam hammer, suspended between two heavy timber uprights, which served as guides to hold the hammer in the proper position while raising or lowering it. The bottom of the hammer cage connected to the top of the core and the casing. The core was driven until 10 blows caused not over 1 in. penetration. The piles were so designed and placed that with the dead load and 50 per cent. of the live load on the building each pile would have approximately 25 tons on it.

Forty piles out of the total number driven were tested. The maximum settlement under a maximum test load of 50 tons was 3-16 in. Some piles were tested under a 35-ton load only. The tops of the piles were required to be of various elevations in different sections of the foundations, due to a sub-basement, boiler

pit, etc., having low floor elevations. Under most of the footings, piles were staggered about 3 ft. on centers in order to get the required number within a minimum area, and this reduced the size of the pile cap covering them. In all cases, the center of the pile was required to be 1 ft. 6 in. from the edge of cap. Accepting 25 tons as the approximately correct load to be carried by each pile, the foundation of piles will carry (when the building is about 50 per cent. live loaded) something like 1,200 x 25 tons, or 30,500 tons load. The cost

of these piles was for the first 15 ft. driven, an average of 85 cts. per vertical ft. For depths greater than 15 ft. a handbook issued by the MacArthur Concrete Pile and Foundation Company, states that as a rule, the prices will vary from \$1 to \$1.25 per lin. ft. of pile. For a very small or a very large job, however, the cost may run respectively higher or lower. In general the price per lin. ft. of the pedestal pile is as low as that of any other cast-in-place pile, and much lower than that of the cast-above-ground pile.

The Prevention of Dampness in Buildings

By George Melson, F.R.I.B.A.

ONE of the most important points to observe in building operations is that of keeping dampness out of all parts of the structure. The dampness may be caused by (1) there being no damp-proof course, (2) the damp rising from the ground, (3) the damp earth against the walls, (4) rain soaking in through porous parapet walls and copings, (5) driving rains against walls, (6) burst pipes or leaks in roofs and other causes avoidable by a proper state of repair being maintained. Beyond this last cause, which should never obtain at all, to attempt after the building is occupied to remedy any of the other five omissions or faulty construction is a costly operation. For example, the cost of inserting a damp-proof course into a wall constructed without one is about as five or six to one, according to the material used, as compared with the cost of putting one in at the time the building is erected.

The provision of a damp course is in most towns a necessity, as the building laws require one. Some of the materials in most common use for this purpose are a double course of slate in cement, sheet lead, hard blue bricks, glazed stoneware slabs or tiles, asphalt, asphalted felt, etc., such damp courses laid costing from about 3d. (6 cents) per foot superficial for bituminous sheeting (in rolls) to 1s. (25 cents) per same unit for thick sheet lead.

The chief point to observe is that the damp-proof course covers the whole of the wall, and in the case of slates that they are of a stout quality and correctly laid to break joints and are properly bedded above, below and between each with cement mortar gauged one of Portland cement to one of clean sand. For appearance sake, and to prevent a lodgment for rain, moss, etc., the slates are generally kept back one-half inch on the outside of the wall and the damp-proof course pointed up in cement with a flush joint. Too much care cannot be taken to ensure that whole slates are used (and new ones at that), for unless this is so a straight joint occurs; then if the cement-mortar cracks when set at this point water can ascend in the wall by capillary attraction.

It would appear to be a simple matter to lay a damp course of slates in cement, but it is a matter wherein an error in method can be made, and, as usual, it is one of those small errors impossible of remedying when covered up. The cement compo bed should be spread over the wall to be covered, preferably by the laborer, with the back of his shovel, or, failing that, by the bricklayer with his trowel, and at this point the bricklayer should commence the laying of the slates; but it is no uncommon practice for him to first of all cut the bed of compo across and raise it, as it

were, into a series of small ruts or ridges, and on these to put the slates, tapping them home with the edge or the handle of his trowel. These ridges remain and set as such, and so the slates only have bearings at certain portions of their surface and invariably crack or snap at these points.

Sheet lead as a damp-proof course is the most expensive, as the lead should not be less than 5 lb. per foot super in weight. The bed on which it is laid must be smooth to prevent the roughness of the bricks or stones cutting through it, but at the same time its substance allows it to adapt itself to small irregularities of the surface on which it is laid. One disadvantage of this material as a damp-proof course is that under heavy loads it may squeeze out, and where this occurs the stones may spall off at the edges, for which reason the use of sheet lead between the beds of stones forming a column or pillar is now rarely used.

The cost of laying this damp course is certainly cheap, as it can be put to the exact width required, and the putting of it into position is a simple matter. Its great advantage, however, is as a damp course to be inserted into a wall built without one, where it can be rolled up and unrolled as required as in Fig. 1; but generally where such damp courses have to be inserted the cost of cutting out the brickwork is so high that in many instances the total cost is reduced by using a bituminous sheeting which can be similarly operated.

The use of a course of Staffordshire blue bricks set in Portland cement as a damp-proof course is by no means a good one, as even the best of these bricks are porous, and, this being so, dampness can rise through them. Even where the brickwork for some few courses below the damp course level are of blue Staffordshire bricks a proper damp-proof course should be inserted.

Glazed stoneware tiles or slabs, made to the width of the wall, form a good damp-proof course. They may be anything from 1 in. to 3 in. thick and are 9 in. long. Best stoneware of itself is practically non-absorbent, but when glazed is emphatically so. This material can also withstand heavy loads. Fig. 2 shows this type of damp-proof article, and Fig. 3 a part of a damp course formed of this material.

The perforations through the slabs are of great use, forming an excellent method of ventilating the underside, and particularly the corners and spaces under the wooden joists of ground floors so necessary if dry rot is to be avoided. Once more the bricklayer can spoil the efficiency of this damp-proof course in the jointing of the blocks or slabs. The groove or perforation at the joint is apt to become filled with mortar when moisture from the courses of brickwork beneath the glazed slab may rise up through this

mortar in these vertical joints into the brickwork above and thus defeat the object of the glazed tile course at every 9 in. of its length. This defect is easily avoided by the foreman seeing that no mortar is put to this vertical joint, but that the hole or perforation is left quite clean and free from any jointing material. An attempt to overcome this difficulty on some jobs is often made by filling up the end grooves x and x in Fig. 2 with cement; but the cement as used is rarely of itself damp-resisting, so that this method cannot be said to get over the difficulty. Again, the cement joint may crack, when moisture can rise by capillary attraction, so it is much wiser to leave the perforations unfilled.

Asphalt as a damp-proof course is perhaps the best of all materials used for that purpose (excluding sheet lead on account of its greater cost). It is easily laid, is elastic to a certain extent, and yet able to withstand great pressure. There is also an entire absence of joints, and this is a particularly good advantage, as the joints in all other damp-proof courses are their weak points. At the same time care should be taken to see that the asphalt is from a reputable firm, as some are much too brittle, while others squeeze under a comparatively small load, nor yet can some withstand the heat as the better material can, and others are merely a mixture of coal-tar, pitch and sand.

Before any asphalt is laid the brickwork should be leveled, and it must also be dry and brushed clean, leaving the joints well flushed up with mortar. The

course of brickwork to receive the asphalt damp-proof course should be laid with the frog downwards; in all other positions it is generally laid uppermost to insure it being filled up. The asphalt course should be of an even thickness, $\frac{1}{2}$ in. or $\frac{3}{4}$ in., as may be specified, and to insure this correct thickness screeds must be fixed to the top edges of the length of the walls when the molten asphalt is poured on and surfaced with wooden floats.

In order to make quite sure of the perfectness of the jointing necessary say, from the leaving off of one day to the commencing on the following one, the last foot or 18 in. of the over-night work should be left but $\frac{1}{4}$ in. thick, allowing the next morning's work to complete the thickness insuring a waterproof joint.

Asphalted felts are serviceable as damp-proof courses, but care must be taken to see that the one used has a real claim for that purpose. Some simple tests to judge the quality and usefulness of some of the felts on the market are as follows: (a) To fold up the corners in such a manner as to form a tray, and if such tray will retain water for twenty-one days, leaving the underside of the felt perfectly dry, the sample may be considered good enough for its purpose; (b) pull the sample to pieces to see that each and every fiber is thoroughly coated with asphalt or bitumen. This last is important, as in the position in which it is to be used its edges would harbor insects, fungus, etc., if the felt was not saturated with bitumen to prevent it rotting. This liability to rot is one of the great

The Prevention of Dampness in Buildings, Illustrating Some of the Remedies Suggested.



Fig. 1—Inserting Damp Course in an Old Wall



Fig. 2—A Glazed Stone-ware Slab as a Damp-proof Course

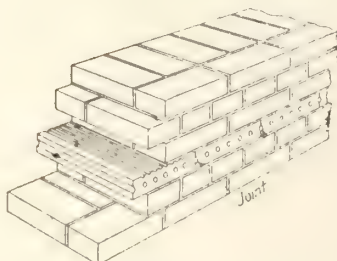


Fig. 3—Portion of a Wall Wherein the Slab Shown in Fig. 2 is Used as a Damp Course

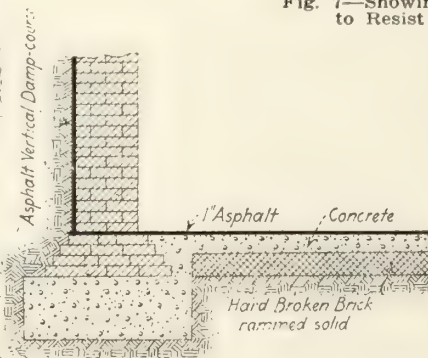


Fig. 6—Damp Course on Outside of Wall Below Grade and Extended Through Wall to Form Top Surface of Cellar Floor

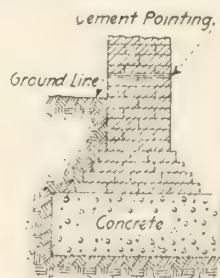


Fig. 4—A Damp Course of Slate

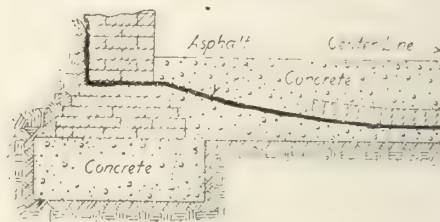


Fig. 7—Showing Arrangement of Damp Course to Resist Upward pressure of Water

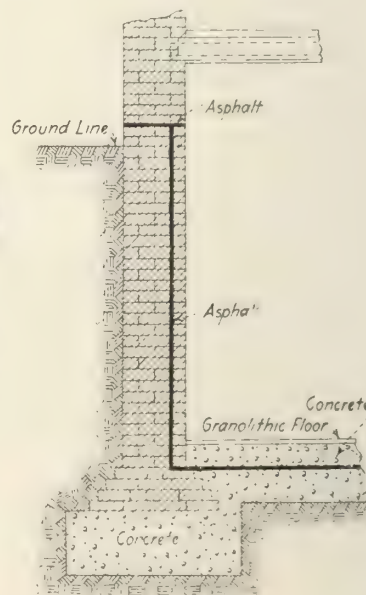


Fig. 5—Wall Rendered Damp Proof with Asphalt and Half-brick Built against it; or a space Left in the Brick Work and Hot Asphalt Poured in at Short Heights of the Work

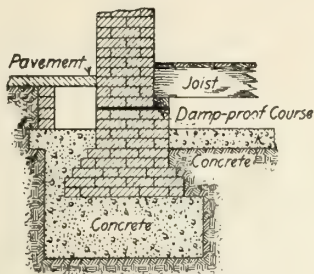


Fig. 8—Dry Area Where Floor and Pavement Are Practically Level

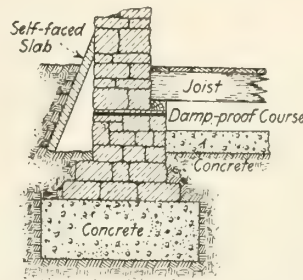


Fig. 9—A Cheap Form of Dry Area Common in Laminated Stone Countries

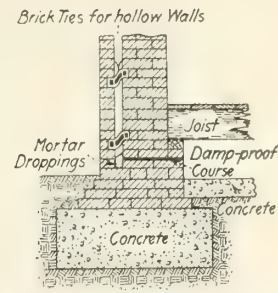


Fig. 10—Case Where Mortar Droppings Cause Dampness by Capillary Attraction

The Prevention of Dampness in Buildings.

disadvantages of felts as damp-proof courses, and as such some of the makes on the market hardly come within the meaning of the model by-laws of the Local Government Board, "or other durable material impervious to moisture," for which reason asphalted felts are not permissible in some towns as a damp-course material. Some of the best makes of asphalted felts are guaranteed by the makers as being both "durable" and "impervious to moisture."

The second heading mentioned as a cause of dampness in buildings is that of dampness rising from the ground. To overcome this cause of dampness the model by-laws provide for a layer of good cement concrete rammed solid, at least 6 in. thick, to be put over the site to seal the ground air.

The number of voids in soils, as also their power of holding water, varies; but it may be said that all contain in smaller or larger quantities certain volumes of "ground air" at the surface and "ground water" below. As the latter rises or falls, according to the heaviness of the rainfall, so the "ground air" in the pores, so to speak, of the soil rise and fall, being on occasions expelled from the ground; also this ground air is drawn from the soil beneath a house on account of the greater warmth of the rooms over the site; also a rising temperature or a falling atmospheric pressure may extract or draw out such ground air.

Ground air is always impure, often resulting from the decomposition or decaying of vegetable or organic matter, or from soakages from defective drains, cess-pools, etc., hence the great need of the asphaltting or concreting over the site, as required by the model by-laws.

The concrete used for this purpose must be "good," but it is certain that a large proportion of the concrete put over sites is mere rubbish, often being merely placed on top of the ground, the turf not even being removed. The by-law does not ask for the concrete to be floated to a smooth surface on top. It is to be regretted that it does not, as it would the better ensure, at any rate, the top half of the 6 in. of concrete acting effectively, as some of the concrete put down by speculating builders is deplorable.

It is possible that in basements the floor may be below the standing level of water, when, in addition to preventing the water entering the side walls, it may be desirable to make the basement practically a water-tight tank; and in cases where great pressure of water is found it may even be necessary to reinforce the concrete over the site in order to prevent it being lifted by the upward pressure of the water. Sev-

eral methods of making basements water-tight are shown in Figs. 5, 6 and 7.

In these same illustrations are shown methods of sealing the basement side walls against dampness coming in through them by reason of the damp earth next them, which was mentioned as the third cause of dampness in buildings. Some such provision is always necessary when the lowest storey of any building is below the level of the surface of the ground. In the words of the model by-laws, "that where any part of a floor of the lowest storey of such (new building) shall be intended to be below the level of the surface of the ground immediately adjoining the exterior of such storey, and so that the ground shall be in contact with the exterior of such wall, he shall cause such storey to be enclosed with double walls, having an intervening cavity between such walls of a width of 2½ in., and extending from the base of such walls to a height of 6 in. above the surface of the ground immediately in adjoining the exterior of such storey."

Several forms of cavity walls and dry areas are shown in Figs. 8 to 13.

Care must be taken to observe that mortar fallen into the cavity between the two thicknesses of brickwork does not defeat the object of the hollow ways by allowing moisture to be drawn across it and up the interior wall by capillary attraction, as shown in Fig. 10.

Dampness of Parapet Walls

Parapet walls are generally built of facing bricks—at any rate, on one side—and this class of brick is more frequently porous than that used for the general brickwork, so consequently it behooves the architect to find some means of preventing water penetrating downwards through the brickwork forming the parapet. One method is to build the whole of the parapet wall in cement-mortar, and, even better still, to insert one of the damp-proof courses already mentioned. Even when stone copings replace brick-on-edge and tile creasing the same need for keeping water out obtains, the stone being porous. Where it is possible it is much preferable for the slates to go over the gable ends of walls and form verges rather than have parapet walls to them.

Driving rains are a very common cause of dampness in buildings, particularly where the latter are in exposed positions. This condition may be met by building with hollow walls or by tile hanging them. Where the need of prevention of dampness from this cause has been overlooked resort has to be made to covering the walls with slates or tiles afterwards.

Other endeavors that have been tried are applying hot boiled oil to the brick walls with a large paint or similar brush. Dry weather should be chosen for this coating or coatings, and preferably a sunny day, when the walls will have been warmed by the sun.

Hot tar and melted pitch have been employed for the same purpose, in the same manner, and often to improve the appearance of the wall crushed shells or clean sand is thrown on to the tarred surface before it has set hard.

Treatment of Brickwork

Another method that has been tried is to give the brickwork a coat of soft soap, followed by a coat of alum. There are also fluids specially made for the purpose of filling the pores or voids in the bricks and so stopping their porosity.

Lack of proper maintenance forms the sixth cause of dampness in buildings and is unhappily the most common of all. The ways in which slates or tiles get cracked or broken are countless. Workmen repairing or renewing glass in skylights, cleaning out gutters, telephone linesmen, are all responsible for such breakages.

It is not, however, only by cracked or broken slates that rain water is let into the most vulnerable part of

narrow, leaving a space instead of giving a lap, and as this is the lowest end of the roof, where the water collects in larger quantities, and where, consequently, the best lap is needed, rain soon finds its way through, but instead of plastered ceilings indicating the leakage the water soaks into the brickwork, and appears soon after in stains on the paper of the walls of the room.

Cause of Leaky Roofs

Often roofs become leaky by reason of the timbers of the roof settling, or by insufficiency of strength to support the roof covering and workmen at times of repair or the additional weight of snow, at other times. In such cases the roof should be strengthened by strutting or furring it up.

The use of narrow strips of slate held, often, in position by one nail (two being impossible in the width) instead of using slate and a half or double slates is a cause of leaks in roofs, the small strips frequently getting displaced.

The careless or wilful boiling of leadwork in hips and valleys may lead to drops of water entering the roof, as also the use of slates holed incorrectly and reversed end for end.

On zinc or lead flats rain often drives or is drawn

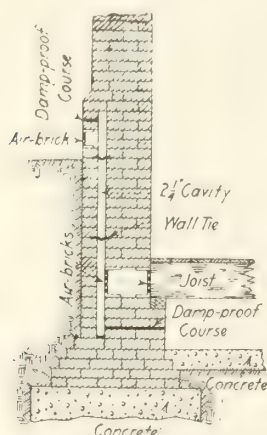


Fig. 11—An Example of Hollow Wall and Method of Treatment

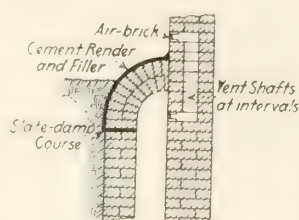


Fig. 12—Dry Area with Ventilation Shafts

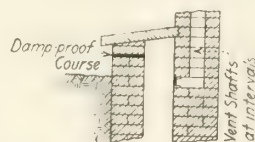


Fig. 13—Variation of Dry Area Shown in Previous Figure

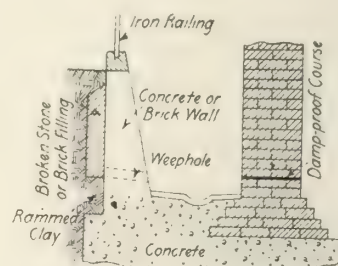


Fig. 14—An Open Area



Fig. 15—Types of Ties for Hollow Walls

The Prevention of Dampness in Buildings.

a building—the roof; it is sometimes caused by an absence of proper lap in the slating in the first place. The insufficiency of lap may not be all over the surface of the roof, and even if it is it may not be necessary to strip the lot, but rather, as a trial, it would be best to strip a patch about 4 ft. super. around where the water is penetrating and to give an extra lap to the tiles or slates if able to do so, or pieces of zinc can be inserted between the slates, pushed up as far as the nails will allow, but showing below the edge of the slate.

Slaters may vary the lap, and they frequently do so. Starting with the specified lap at the bottom, they gain the confidence of the clerk of works at the outset, and he is perhaps thereby induced not to pay the strictest attention to the slating work, and is consequently 'diddled' by loss of lap higher up the roof. However, the fault is not as bad as it could be, as if there is to be any change in the lap it is more necessary to have a larger one at the bottom than at the top of the roof, as the greatest volume of water collects at the former end.

Another cause of water finding its way through a slated roof is that the undereaves course is often too

by capillary attraction over badly constructed rolls. The cloak of the lead covering of a roll should always be on the opposite side to that of the prevailing winds or rains. If flats are liable to be much walked on battens should be placed on them after the manner of snow gratings, and the same precaution should be adopted in slated roofs by providing cat or duck-ladders for access to the various parts of the roofs.

Other Causes of Dampness

Other causes of dampness are leaky or choked-up gutters. Both defects are heralded by falling or running water, and there is no excuse for gutters remaining in their bad condition long enough to cause real dampness to the walls. In searching lead gutters for defects, it is necessary to wipe the inside surface dry to find the crack, which will generally be noticed by water oozing from it.

Other items in a building requiring periodical inspection to avoid dampness entering are skylights, the timbers and putty of which rot with time unless properly coated with paint at regular intervals; and, lastly, it is necessary to keep all drains in good and clean working order.

The Qualities of Sheet Asphalt*

By George Norton†

WITHIN the past few years certain changes have occurred in traffic conditions which have largely eliminated one former standard road construction and it is well to look forward to the effect of these changes upon sheet asphalt through the introduction of heavy motor traffic. The truck with wheel load of 5,000 lbs. and upwards is now common on such pavements. For a pavement now laid which is to endure at least 20 years in the future, wheel loads of 10,000 lbs. or more may reasonably be expected. To meet these conditions there must be sufficient base to carry the load, sufficient tensile strength in the surface to withstand the tractive stresses and all possible adhesion or resistance between top and base to prevent relative movement.

The notes here presented are from experience in the maintenance of asphalt in Buffalo, N. Y.

The first sheet asphalt was there laid in 1878 and more or less has been laid every year since then. About five and one-half million yards have been laid of which about four and one-third million remain. The oldest in service is 9,000 yards laid in 1881 and 26,000 in 1882. About two million yards are 20 years old or more. An average life of at least 21 years is expected. Much of this pavement was laid on 6 inches of natural cement concrete for a base. On some of these streets there are now appearing small circular depressions without rupture of surface. It is assumed that these are due to a breaking down of the base by heavy traffic loads. These will undoubtedly be followed by a corresponding break in the surface. Under this assumption of cause and effect, this base is not sufficient. This 6 inches of natural cement concrete may be equal in carrying strength to 4 or 5 inches of Portland cement concrete, and such may therefore be assumed as of doubtful strength for a satisfactory foundation.

Many English cities are now using from 8 to 10 inches and even 12 inches of concrete for pavement base. This change has arisen from their earlier and more extensive experience with heavy motor traffic.

In the large cities it is also necessary to route heavier loads up to 30 or 40 tons over some streets. At present we use a 6-in. Portland cement base on all pavements, but this will now be increased to 8 ins. on certain heavy traffic streets.

No base should be expected to hold over extended settlements in the underlying soil, but should not shear down over small depressions or soft places.

If we assume the circumference of one of the above noted pothole depressions as 30 inches in a 6-inch base there would be 180 sq. ins. in shear. At the common assumption of 60 lbs. per sq. in. for concrete shear, the safe working load would be 10,800 lbs., or a safe strength for motor truck loads but not for occasional loads of 15,000 or 20,000 lbs. per wheel.

With a satisfactory base provided, the strength of the top must be considered. With a motor developing 60 h.p. at 10 ft. per second, the tractive effort on each of two wheels would be 1,650 lbs. If this be distributed over 8 inches of wheel face there is a tensile stress of 200 lbs. per lin. in. of tire transferred to the pavement surface. If this be resisted by but one inch in depth of surface there is a stress of 200 lbs. per sq. in. within the asphalt surface. Will it always stand it? With a plastic top mixture there will undoubtedly

ly be some surface displacement; with a hard mixture or in cold weather may not a thin top be ruptured? These are only offered as suggestive questions to those who have inclined toward a thin surface, or for the possible effect upon surface repairs where new material in a thin layer may not be thoroughly welded to the underlying material.

The Binder Course

This question of surface movement under traffic naturally leads to consideration of the binder course. What is here said may be considered as hearsay in accepted asphalt practice. Buffalo has continued to use the open binder although the close binder is most generally recommended and used. We have continued the use of open binder after full and conservative consideration that there are yet sufficient sound theoretical reasons only to be set aside by proved results. The main function of a binder course, as the name implies, is to connect the wearing surface with the base. Another function may be considered as that of protecting the surface from moisture in or upon the base. No material adhesion of any binder to a concrete base may be expected unless possibly through an applied paint course. With an open binder thoroughly rolled in a thin layer the sharp-edged pieces of stone must be forced into all inequalities of the concrete base and to a greater extent than if partially supported by a matrix. The topping when rolled on this open binder is forced down and into the interstices from $\frac{1}{2}$ to $\frac{3}{4}$ in., thus forming an asphaltic concrete having much stability and integral with the topping.

An argument in favor of the close binder is that it resists disturbance during the laying of the top and may even be safely used for some light traffic. But this very advantage introduces the well known difficulty of making proper adhesion where the surfaces are smooth and have dust and increases the danger of cleavage or movement along the joint plane. For resistance against lateral forces there appears a material advantage for open binder into which the surface mixture may be so forced as to obtain positive bond.

Another possible advantage of the open binder is that it provides a small but distinct drainage course for water passing the surface at car tracks or through breaks.

The points here intended to be emphasized are that the standard sheet asphalt is a paving material having excellent resistance to wear when properly supported. This support must be not only vertical by provision of a stable base, but lateral by a sufficient thickness within itself to withstand tensile traffic stresses without tearing and having continuity to transfer these stresses to the base in the most direct manner. Unless these supports are fully provided this pavement can not successfully meet the increased traffic requirements most evident for the future.

Surface finish for concrete was given attention by the Board of Water Supply of the City of New York in connection with bridge construction on the Catskill aqueduct, and of several methods examined for securing even, clean textures the use of selected aggregate of pink granite for mortar facing was successful in special cases, according to the board's annual report. The mixture was poured by the aid of a sheet-iron diaphragm, moved as the backing was poured, the facing and backing being thus placed as a monolith. Experiments showed that the most practical ways of treating concrete surfaces were by pneumatic hammers and by sandblasts.

*Paper presented at the tenth annual convention of the American Road Builders' Association, Philadelphia, Pa., Dec. 9-12, 1913.

†Deputy Engineer Commissioner, Buffalo, N. Y.

From the Saskatchewan Capital

Correspondence of the Contract Record

REGINA was the scene of active constructional development last year, despite the financial stringency which obtained during the closing months. While the building permits amounted only to \$6,302,945, a great many structures were erected for which permits were taken out in 1912. Among the latter were the G. T. P. hotel building at a cost of \$1,000,000, the McCallum, Hill & Company building, estimated to cost \$500,000, and the Canada Life Assurance Company's new six-storey building, all of which have been described at various times in the Contract Record.

Among the buildings of more than passing interest erected last year were the Normal School, designed by



The new R.C. Cathedral at Regina.

Messrs. Storey & Van Egmond and built at a cost of \$250,000, and the new Roman Catholic Cathedral, which cost over \$200,000. Another building of note was the Telephone Exchange Building, the erection of which entailed an expenditure of \$75,000. It speaks well for the general business development of both

Regina and the province that during 1913 the space occupied by departmental stores increased three-fold. In this field the most noteworthy addition was the Sherwood departmental store, erected at a cost of \$420,000. Last year also witnessed an extensive addition to Regina's pioneer departmental store, that of the R. H. Williams Company.

Mention has only been made of a few of the buildings deserving of note. There were a number of structures for the School Trustees; an addition to the Collegiate Institute, costing \$100,000; a new Provincial Jail, costing \$250,000, and the arena, built at a cost of \$150,000; but enough has been said to show that the constructional development of Regina is proceeding satisfactorily and that the city is not located in a zone of depression.

It is of passing interest to mention that Regina is one of the few Canadian cities which showed an increase in bank clearings last year, the figures being \$132,087,457, as compared with \$115,727,647 for 1912.

The building permits issued in the city of Toronto last year amounted to \$27,038,624, thus practically tying with the total for 1912, which was \$27,401,761. Last month's returns were \$1,448,768, compared with \$1,936,685 for December, 1912. The number of permits issued in 1913 was 9,084 and in the preceding year 10,217.

The report of the delegates appointed by the British Board of Trade to the sixth Congress of the International Association for Testing Materials, at New York last year, has recently been issued. The delegates report that on all points which appeared important to the British representatives the decisions arrived at by the Congress were satisfactory to them. The report asserts that there is general consent that if international specifications for iron, steel and cement could be agreed upon, advantage would result. The delegates make the following recommendations for the consideration of the Board of Trade:—(1) That his Majesty's Government recognize the International Association for Testing Materials by continuing to appoint delegates to the periodical Congresses, with instructions as to their duties; (2) that a subvention to the funds of the Association should be made either directly or through the departments interested in the work of the Association; and (3) that should the Congress meet in London in 1918, his Majesty's Government should accord the Congress official recognition.



Normal School, Regina, erected at a cost of \$250,000, Architects, Messrs. Storey & Van Egmond.

Correct and Incorrect Methods of Factory Lighting

By G. H. Stickney

THE economic value of good illumination, aside from accident prevention, is evident in the greater facility with which an employee can work under good illumination and the greater accuracy with which gauges can be read and tools can be set. One large manufacturer, on investigating his lighting conditions, found certain departments in which the operatives were practically idle for about an hour a day during the winter months, solely on account of darkness. Good artificial illumination can be furnished in such a factory for eight hours a day at a cost equivalent to about five minutes of the time of the workmen benefited. This illustrates the extravagance of poor lighting. For a great variety of conditions good illumination reduces the manufacturing cost by increasing production, raising the quality of workmanship and reducing the number of defective parts and "seconds."

Accident Prevention

The phase of accident prevention is illustrated in the case of the foundry or other shop where cranes or other powerful machinery are in operation. The likelihood of crane and elevator accidents is greatly reduced with proper lighting. In the foundries and yards of a plant it is practically impossible to eliminate irregularities under foot. If not illuminated, these may readily cause falls, with resulting injuries; and in foundries where molten metal is carried and hot metal abounds they may often cause serious burns. Even though guarded to the fullest extent, powerful machinery presents a menace unless the operatives are given an opportunity to see and thus avoid the danger points.

As to the preservation of the eyesight, there are many manufacturing operations which cannot be carried on without accurate visual inspection. Some of these produce considerable strain even under good illumination, and to require their performance under poor illumination is certain to result in more or less rapid impairment of vision.

Undoubtedly a higher intensity of illumination is needed in most workrooms, but there are other features of equal and sometimes greater importance. The minimum intensity acceptable generally depends upon the reflecting power of the surfaces to be seen, the fineness of the detail to be observed, the time of observation and the closeness of application. Unless glare be introduced, a higher intensity of light is rarely objectionable, except from the standpoint of cost. The gain secured by the increase of intensity is not proportional to the intensity, and there is a point beyond which the gain would not warrant the additional cost.

The most common defect in lighting is excessive glare and absence of diffusion. Glare may emanate directly from the light source or be reflected to the eye by a glossy surface; it can also be caused wherever excessive contrast of intensity appears in adjacent fields of vision. The dazzling effect is unpleasant and interferes with seeing. Under continued exposure eyestrain and even permanent injury to the eye may result. An unshielded light hung over a machine is a common source of eye fatigue. The glare may not be so evident on first glance, but when the workman's eyes have been subjected to such light for a long time discomfort and inability to see result.

Use of Reflectors

The workman frequently complains of insufficient light when in reality the intensity may be higher than is required

for the work. In case an attempt is made to correct this by installing a larger light, the workman's eyes are subjected to a still more severe strain. The proper correction should be to shield the light by means of a proper reflector. As such a reflector would tend to direct more of the light upon the work, the working intensity would be increased; hence in many cases it may be possible to reduce the size of the lamp, or relocate it so as to enlarge the area illuminated.

When a light cannot be removed entirely from the field of vision its brilliancy should be reduced by means of a diffusing globe or reflector so as to increase the apparent size of the light source and reduce the contrast between it and the background and the sharpness of shadows in the illumination.

Glare received from specular reflection of glazed paper, desk tops or polished metal often induces eye trouble, headache, and other indispositions, though the sufferers may not be aware of the cause. The remedy is to change the relative positions so that the reflected light is kept out of the eyes as much as possible and to enlarge the dimensions of the light source.

Proper Distribution

Another defect commonly found in industrial lighting is improper distribution. This may be due to too wide a spacing of lighting units. Under this condition some parts of the room are insufficiently lighted, while other parts may have more light than is necessary.

Improper direction of light may illuminate the wrong side of the machine, leaving the important parts in shadow. If the bright parts are near the shaded ones, whatever illumination may fall upon the shaded portion is rendered less effective by contrast.

Unsteady or flickering illumination is always objectionable. Such variation should always be avoided, whether caused by the units themselves or by the light passing through such things as moving wheels.

Good illumination cannot be prescribed without knowledge of the use to which it is to be put. In order properly to plan the lighting of a factory one should be familiar with the processes employed, the arrangement of machinery and work tables and the quality of product manufactured. Experience gained in well-lighted factories should be utilized in planning lighting installations.

The Grand Trunk and Can. Pacific railways have effected an agreement regarding the building of the new Union Station at Toronto. Mr. Drayton, Chairman of the Dominion Railway Board, is expected to issue an order requiring the work to be proceeded with at once.

The York County Highway Commissioners, in their programme for the current year, are planning a comprehensive scheme embracing all the main roads in the province. They will seek to compel the railways and owners of self-propelling vehicles to pay a considerable part of the cost of road maintenance. The commissioners believe that the provincial government should assume responsibility for maintenance of all the leading roads serving large centres of population, while highways connecting rural municipalities for county purposes should be maintained by the county. A substantial Dominion Government grant is urged.

Engineering Responsibilities and Lay Administration

That many readers take a vital interest in the suggestions put forward in the editorial article published under the above heading in our issue of January 14 is evidenced in the letters reproduced below. To facilitate a perusal of these letters on the part of those who did not read the editorial article in question, it may be well to say that our discussion centred around Montreal's unfortunate experience with its conduit, a break in which shut off the water supply for several days. The pivotal idea of the article was to direct attention to the unsatisfactory results which are obtained from the final direction of engineering matters by incompetent politicians. The presentation of this subject editorially was designed to originate discussion—with what measure of success the communications published in this issue will indicate. Many valuable ideas have been brought out in these letters, and it is to be hoped that the time and thought expended upon their preparation will not be in vain. A discussion of this kind has a well-defined educational value, and in stimulating thought on the part of those identified with municipal engineering it furnishes them with a most effective means of maintaining their proper status in the community and upholding their reputation at times when public criticism runs wild. It will be noticed that the commission form of government is favored strongly by several writers, notably City Engineer Macallum, the kernel of whose contentions is contained in the heading below which his letter is published. A careful analysis of the whole subject is made by Mr. John T. Farmer, of Montreal, whose ideals of civic administration are fulfilled in the government of a number of representative cities of the old land. A forcible presentation of the argument in favor of a smaller governing body comprising a centralized, specialized authority is made by Paul Chomedey. "An English Civil Engineer" holds the opinion that much of the trouble in municipal engineering in Canada is attributable to the fact that this branch of the profession has no organization. "Mekanikos" believes that an effective remedial measure would be the establishment of a Department of Municipal Administration—a suggestion which, in our opinion, has much to commend it.

Councils Usually Controlled by Three or Four. Why Not, Then, a Commission?

Hamilton, Jan. 20, 1914.

Editor Contract Record:

The seal of approval from a city's administration should mean something. If not, why should it be necessary? It is usually assumed that an "approval" is given by those familiar with a subject. If an approval of such be given it is equivalent to an endorsement. If not, what use is it, except to show that a matter has been before a council meeting?

Referring to the Montreal conduit collapse, I understand that the engineer has letters to show that he recommended a duplicate conduit, but that the council, in their wisdom, thought that only one was necessary. Even under these circumstances it may be assumed that though the council took the responsibility it will not take it now but will climb quickly out of the way, so that there may be no obstruction in getting a good shot at the engineer.

When an accident such as the above has occurred and the repairs must be made hurriedly, it often happens that the best means are not adopted. An engineer carrying out any particular construction usually finds that if he were to do it over again he would probably carry it out (in at least some details) in a different manner. For this reason Mr. Phelps Johnson's criticism is very much more likely to be fair than that of Professor Brown, of McGill, especially when you take into consideration the haste with which a decision on the method of re-construction will be carried out.

In Toronto there have been submitted two reports on the development of the water-works—one by a Commission and the other by the City Engineer's staff. How is the council, as constituted at present, able or competent to pass on the relative merits of the two schemes? Is it not probable that the merits of each case will not be carefully considered and that the council will either follow blindly one or other of the schemes or shelve the matter to some remote date, if possible?

The usual council is generally led by three or four men more or less familiar with city business. These men carry along the majority of the members, who are seldom familiar with most of the items on the list of business at the council

meetings, unless it directly affects something in which they are personally interested. The votes of these men count, however, and on a subject of little personal interest, or lack of understanding to them, they may assist in carrying through some measure that is detrimental to the city at large.

Since the council is controlled usually by three or four of its members, it might as well be carried on by that number. Until the public and press, however, are trained to municipal responsibility far beyond the present state, it is difficult to see how any Commission stronger than the usual Board of Control is likely to be appointed, and until such time I see little hope of betterment in civic administration. If the candidates for such a Commission could be limited to men possessing certain qualifications, it would assist materially in obtaining a Commission that would, at least, commence business with a basis of special individual training to work upon.

Faithfully yours,

A. F. Macallum,
City Engineer.

Suggested Department of Municipal Administration

Editor Contract Record:

While arguing in support of a better system of municipal government, I have been faced with the answer that it is not possible to standardize civic administration, but that each municipality must be dealt with distinctly according to its individual needs. That may be so, but when we reduce the facts to a common-sense, material basis of dollars and cents, he must be a very complacent individual indeed who would bolster up the system now generally in vogue. Eliminate all big cities for the moment and consider an average town of, say, 10,000 population. The assessable value of such a corporation would be approximately three and a half million dollars, and the money actually received annually by taxes would be about \$150,000. This money is turned over to ten or a dozen men, for the most part store-keepers or workmen—excellent men in their sphere no doubt, but too often wholly ignorant of financial or technical matters—who are somehow

considered sufficiently competent to devise and advise ways and means of administering the money in their charge and all the purposes the money can command. To their credit be it said that their intentions are almost always good, and in the majority of cases the honesty of the men is beyond question, but can you imagine any company promoter, or stock jobber, trying to promote the welfare of a private company capitalized at three and a half million dollars and with an annual expenditure of \$150,000, with its directorate consisting of men of the calibre and status mentioned? He would need to be a very plausible speaker to convince any possible stockholder that his investment would be worth more than blank white paper. It may not be possible to standardize municipal government beyond that already done by the several municipal acts, but, to my mind, there should be a Department of Municipal Administration in both federal and provincial cabinets. Systems of inspection of all municipal departments could then be established.

The different cities and towns could be grouped and classified according to a certain standard. All officials should at least comply with a certain standard set by the Government and each appointment should be made on merit along the lines laid down by a Civil Service Commission. I believe that this would bring about the methodical operation of municipal affairs, for the system of inspection would insure the regularity of all accounts and records, while the standard required for officials would mean competency on the part of the individual. The calling for tenders and letting of contracts would be done according to a standard set or approved, copies of specifications would be filed, and a Commission of Inquiry could deal with extraordinary phases of work. Then in cases of dispute it should not be difficult to touch the spot and indicate where discrepancies had appeared, poor judgment had been shown or wasteful expenditure had taken place.

Yours truly,

"Mekanikos."

Crying Need for Executives of Higher Calibre

Montreal, Jan. 21, 1914.

Editor Contract Record:

Your editorial on the subject of Engineering Responsibilities appears to be a temperate and well-considered reflection on the circumstances surrounding the recent failure of the water supply of Montreal.

There is always a tendency, on the occurrence of any such calamity vitally affecting the welfare of the general public, to rush into a hysteria of criticism and denunciation of the nearest and most obvious causes of the misadventure. Such hysteria is usually fomented and encouraged by the sensational press—as in the present instance—and in the heat and indignation of the moment many things are printed and repeated from mouth to mouth that would not be said at all, or would be expressed more sympathetically, after due consideration. Such hysterical outbursts in the social as well as the physical organism have no curative value whatever: they are simply an evidence of weakness and leave a greater weakness behind them.

Assuming as an axiom that there is no such thing as an accident in Nature, and that for every event a cause can be found if it can be traced, then the responsibility for the recent disaster, in my opinion, is to be laid at the door of every citizen who has or should have taken part in the administration of the city during the last ten or fifteen years. It is very easy to lay the blame for such an occurrence on the official immediately responsible, but it must be remembered that every official is bound and limited by circumstances beyond his control and that the best he can do is to strive to overcome the difficulties imposed by the limitations with which he is surrounded.

In a rapidly developing country, it is admittedly one of the most serious problems to find ways and means to carry out the projects that are continually pressing for a solution. In many cases it is necessary to apply a solution which is felt to be incomplete but at the same time the best available. We are in the position of an army waging a long-drawn-out fight with superior forces, our hope of success being in attacks in which we concentrate all our resources in the main line of offence, leaving no second line of defence to fall back upon in case of a reverse. Such a policy may have been—and may still be at times—a necessity, but there is reason to fear that we have a tendency to make it a habit, whether necessary or not.

It is to be feared that we have still a good deal to develop in the way of true public spirit in this country. We can point

to palatial homes and places and means of amusement, and we surround ourselves with every personal luxury, according to our means—probably to a greater extent than any other community on the globe—but when it comes to our public administration we do not show the same enthusiasm. Montreal, in population and wealth, now ranks as one of the great cities of the world, but its civic administration is not on a par with a third-rate European town. A city which boasts that its assessed valuation, apart from actual construction carried out, increases something like one hundred million dollars a year, should certainly be able to lay aside sufficient to provide itself with the ordinary equipment of a well-ordered urban community. Instead, the various departments show a similar story of emasculation and insufficiency. The waterworks, an abundant revenue producer for the city, has been notoriously starved as regards new equipment and up-keep. The police force has been shown to be far below the accepted modern standards, numerically, in spite of the fact that the development of crime among certain classes of immigrants indicates the demand for a strong administration of justice. The roadways of the city are a by-word wherever they are known, and recent improvements in dealing with this department have been made the object of a determined attack by self-interested parties, which only called forth a half-hearted and ineffectual remonstrance on the part of the general body of the citizens. The important questions of the disposal of sewage and garbage have only been taken up in the most elementary way. Less essential features of city improvement, such as insanitary areas, the provision of park ways, public library, music hall, street lavatories, public baths, etc., have hardly been touched.

The reason of all this is well known. The system of administration which came to an end with the Cannon Commission of Investigation was shown to be thoroughly inefficient, wasteful and generally rotten. Its effect was the burdening of the city with a heavy municipal debt, with little to show for it, which at the present day absorbs roughly one-half of the available revenue. It is now generally admitted by all unprejudiced observers that the modified system of directing the city's affairs by a Board of Commissioners has been a decided step in the direction of improvement. In my opinion, the lesson to be taken from the water famine is not to cry out for the demolition of the existing form of city government and the substitution of new and radical experiments, but to impress on all citizens who have the welfare of the city at heart the necessity of their giving time and atten-

tion to the study of administrative problems with a view to strengthening and reinforcing whatever is good, and weeding out and revising the elements that are useless or harmful.

The form of government by commissioners seems to have justified itself as the best scheme of administration yet devised, judging from its widespread adoption. In order to secure the best service, it would appear to be desirable—besides making the remuneration commensurate with the demands of such a position, to make the term of service of such duration as to make it worth while for a man of the proper calibre to offer himself, realizing that it means the severance of other important connections and interests that cannot be quickly resumed. For a Board of four Commissioners a term of eight years is suggested as too long, and the individual members should be elected or appointed at intervals of two years, so as to secure continuity of action. Then with a salary of \$10,000 to \$15,000 per annum it should be possible to secure men of the same calibre as those who are given control of the affairs of railways and large commercial enterprises. This is what the situation demands. Whether, in addition, there should be a secondary body of elected local representatives—such as the present council, is rather an open question. Recent events in Montreal have rather pointed otherwise, but still it must be remembered that the existing system has only been on trial for a comparatively short time, and it is impossible to eradicate at once the evils of a preceding regime. On the whole, the system of aldermanic representation of sections of the city has much to recommend it and in my opinion the trial should be continued for a reasonable time. It affords a wholesome check on the actions of commissioners, who must necessarily be invested with wide powers, and it gives the general body of electors a direct voice in the conduct of affairs—which they must have in some form. The evil has been that the dual system has resulted in dissensions and delays, and has tended to impede action. This, it is to be hoped, will correct itself in time by the good sense of the general body in refusing their support to individuals who have demonstrated that their only aptitude is for destructive criticism and obstruction; if it does not, then it will be necessary to cast about for another remedy.

So much for the administrative functions. As regards the technical department of the civic service, it is evident that all positions must be freed from patronage. The scope and responsibilities of each position should be defined and the individuals given a free hand in the exercise of their duties, untrammelled by political considerations. Improvement has been effected in Montreal in these very directions, and much may be done along the same line.

It is easy to condemn a responsible official for any failure in his department. At the same time there may be many extenuating circumstances. Looking round among the various municipalities in Canada, one finds that in the last few years there has not been an increase in the personnel of the technical staffs in municipal employ commensurate with the vastly increased amount of work and responsibilities they have been called upon to undertake. This must have led to great pressure on those in charge, and this condition is one that must inevitably lead to oversights and omissions, consequent imperfections of work, and occasional breakdowns. It would appear timely to take this occasion to put in a strong plea, in Montreal and elsewhere, for the adequate manning of the various technical departments with men of proved ability and value—men whose services should be adequately recompensed and whose conditions of work should be made as favorable as possible.

These may be considered rather high—and perhaps impossible—ideals. Still they include nothing that is not to be found in the representative well-governed cities of the Old Country, and they should be equally realizable here. Permanent improvement can only be reached by aiming at an ul-

timate goal and keeping it steadily in view—not by hasty and spasmodic action, which, only too frequently, simply introduces unforeseen evils in place of those it is sought to remove.

Yours truly,
John T. Farmer.

Is the Municipal Engineer Holding His Own?

Editor Contract Record:

The editorial article, "Engineering Responsibilities and Lay Administration," published in your issue of January 14 was interesting to me because it strengthened an impression which I have been forming for some time, viz., that so little is done for the municipal engineering profession in Canada, and so scurvy is the treatment of men holding office under municipalities, that those of marked ability generally find their way into the service of corporations either here or in the United States. As you know, in England we have the Institution of Municipal Engineers, and other bodies, whose sole aim it is to improve the conditions under which the municipal engineer works. The Institution of Municipal Engineers has taken a decided stand against the over-ruling of "ignorant politicians," which seems to cause you such concern. It has inaugurated a mutual defence scheme consisting of a fund which is at the service of any member who considers that he has been treated unjustly and dishonorably and who may wish to defend his reputation. Your municipal engineer does not enjoy the status that he should, neither does he receive sufficient recompense for his work, except in the case of a mere handful of appointments. Perhaps better conditions will obtain when municipal engineers in Canada have an organization of their own.

What the engineer wants is more influence, a more prominent place in the community and more substantial regard for his opinions.

Is Canada getting the right men into the profession? Is the average engineer equipped, technically and otherwise, to hold his own?

Yours very truly,
"An English Civil Engineer."

Type of Administrator the Factor, not the Form of Government

Editor Contract Record:

Your article, "Engineering Responsibilities and Lay Administration," brings up several questions of the utmost importance to municipal engineers. In most Canadian cities, the engineering department is under the direct control of a Board of Works, or a Board of Control, which, in turn, is responsible to the City Council. If we examine the personnel of any given Board, how many men will we find qualified by their training, either technically or practically, to pass upon the work of the engineer? What does a dentist, a lawyer, or a brick-layer know about the technical difficulties encountered in a city engineer's daily work?

When the engineer recommends a certain work as being required he has to look to the Board to furnish the funds necessary to carry out that work, and how often it happens that, if the recommendation be approved, the Board in its wisdom will make suggestions (commands) which will perhaps impair the efficiency or usefulness of the whole work—though perhaps a few dollars may be saved thereby. The engineer should try to combine the greatest efficiency with the least cost. The members of the Board generally look at the cost and try to cut it down regardless of anything else, thereby securing for themselves the title of "watch-dogs of the treasury" and the approval of the mass of the rate-payers.

The engineer seems to be considered as trying to spend

as much of the people's money as he can, while he may not have nearly large enough an appropriation to carry on his work properly. If, however, his work is not well done, he very soon hears about it—both from the members of council and the press.

The engineer is supposed generally to advise the Council on matters relating to his department, but how often do we find his advice ignored and the Council taking an opposite stand, not because the advice is not good, but because carrying it out might affect a few votes.

The basic trouble appears to me to be an utter disregard of the qualifications of the men elected to administer the affairs of the ratepayers. I do not think the form of government is so much to blame. Any form of government when in the hands of qualified men will be reasonably good, though some forms may be more cumbersome to operate than others. I think that the simpler and more direct any organization or form of government is, the more chance there is of good results. Combine a simple controlling body with few members and the most honorable upright men of any community and we have the best form of government—but—until the majority of the voters wake up to what constitutes their best interests, we shall not get it.

The details of such a government would have to be worked out to fit conditions. In one city it might be necessary to have a highly-paid commission, while in a small place the honor of being a "Commissioner" might be considered pay enough.

From my experience I may say that the councils in the smaller cities seem to take more interest in their engineering department than those of the large cities. I also think that as a rule better men are elected to council in the smaller cities and towns.

Another point is that in most cities there is a change in the personnel of the council too often. The term is too long for an incompetent or dishonest man and too short for a competent, honest man. In other words the government is liable to change too often, with resulting bad effects.

Personally I am in favor of a small commission to control the affairs of a city, with modifications to suit local conditions.

It is the man that counts, however, not the form of government.

Yours truly,

"C. E."

A Centralized, Specialized Form of Government for Our Cities

Montreal, January 20, 1914.

Editor Contract Record:

I have read your editorial article, "Engineering Responsibilities and Lay Administration," which appeared in your issue of the 14th instant and I appreciate its direct application to conditions existing in Montreal—conditions which have been suddenly revealed to the people by a serious failure of the water supply system.

To provide adequate facilities to meet the rapid growth of a city is a very puzzling problem, and unless the administration is a very well-balanced business body it is prone to resort to expedients, sometimes entering upon schemes of comprehensive character and committing the city to large expenditures on works that have been studied but superficially by its departmental officers, aided probably by advice from some imported engineer, all of which if given honest study by a competent business body would have been considerably modified, or else never entered into at all.

On the other hand, the city may temporize by doing as little as possible in the way of carrying out a larger plan—merely adding here and there to its existing systems. As these systems were designed for smaller duty they are soon over-taxed and before long bring about a state of inefficiency in the whole.

Montreal has been guilty of both, and the reason why the city is in its present state is that it has endeavored to provide for its growth while being dominated by an inefficient governing body.

No business concern would spend its money so unwisely and to so little benefit to the shareholders as the city does. The sufferer is the taxpayer. If a board of directors did what the City Council and Board of Control have done and are doing, the shareholders would demand an explanation and find a remedy for the evil.

I do not say that Montreal is the only city that finds itself in this position. Montreal has grown with abnormal rapidity. The civic government has done what it thought best to meet this growth, but it has failed to accomplish what the citizens expect and are entitled to, and the only dividends the taxpayer gets are increases in his tax-bills to pay for work which proves, too late, to have been ineffective and much of it has to be done over again.

A good warning at a railway crossing is, "Stop! Look! Listen!" It would be a foolish person who would disregard the warning. Montreal is at a critical place where caution is necessary.

The late water-works disaster may prove to be a blessing in disguise. We are apt to harp upon it and talk of how the damages were repaired, and many a decent fellow has become an expert all at once and spoiled any good he might have done by declaring that he could have repaired the damage in so many hours. I have done emergency work in flowing water in zero weather, and I know what it means to work day and night. I have no word to say against the men who made these repairs. They did well. Dwelling on such details is useless. These events serve to call attention to a condition of affairs. Stop! Look! Listen!

As soon as the accident happens, one of the controllers is given an idea by a citizen and at once concludes that an emergency supply of water must be provided from the Lachine Canal, and the controllers at once apply to the Legislature for leave to borrow another million dollars for a second conduit.

While there is no need to waste time, there is no excuse for hysterics. As a citizen of Montreal I have to submit to anything that the present governing body may choose to do, and all I can say is that never to my knowledge have they followed a logical or business course, and present conditions prove it—not only in the Water-Works Department, but in many other branches, such as Roadways, Sewers, and even the Fire Department, of which we have reason to be proud, for if care is not exercised we shall soon find our alarm and signal system obsolete.

I have had to do with various councils, boards and governing bodies, and in thirty years' experience I have found that the larger the body the less individual interest is taken by the members of that body. Our governing body is too large. Our ward system tends to develop the petty politician seeking local benefits and ignoring the larger questions, or at least not considering them carefully. His thoughts are local and when he is called upon to give an intelligent opinion on a question of importance to the whole city, his training has rendered him incapable of giving an opinion of any value.

Such representatives (and ninety per cent. are of this

class) when confronted with a serious problem fall back on a departmental head and get his report. Not being able to discuss the matter in a logical or business manner, the report is accepted. The money voted, the work is shoved through, and when done it is found inadequate in many cases—something was forgotten, not provided for.

The responsibility for failure must lie primarily with the council, as in the case of a business concern it would lie with the Board of Directors.

The council cannot hide behind their departmental head who advised them so often and they cannot shift responsibility. It was always in their power to get proper heads of departments. They can now make any change that may be desirable, and appoint better advisers, but the responsibility for what has happened must be theirs.

When I say that the responsibility is on the council, it follows that it is on **the System of Government by Council.**

It is useless to say that aldermen are dishonest. There are many ways of being dishonest. An honest alderman must admit that the present system is ineffective, and yet he clings to it because it is the acknowledged form of government; and he does the best he can, but he knows that he would not conduct his own business in the way the council conducts the business of the city.

A smaller governing body is the first requisite to good government. The whole city should be represented and local ward representation should be abolished. To my mind the governing body should consist of three able men, one of whom should be Chairman. This Board would be responsible for all administration and for all appointments, and the organization would hold each member of the city's staff directly responsible to it for performance of duties.

These three men should be carefully chosen from men of such high standing as our Superior Court Judges, and they should have the business knowledge of a Bank Manager. They should be paid good salaries—as much as a General Manager of a Bank, and far more than our Superior Court Judges. They should be appointed for life or good conduct, or at least for a term of five years, one retiring at a time so as to make the body continuous. All three should be under substantial bonds.

With a responsible governing body like this, we should all have confidence and feel that we had done our best to safeguard our own interests and benefit our city.

How is this change to be accomplished? By the moneyed class, the bankers, railway interests, the merchants, the insurance men? I think not. You must get the working man, the clerk, the younger element to understand that this will mean for them a fairer, better expenditure of the money they pay in taxes. This element is the real city—the poor man and the fairly well-to-do. These should be convinced of the wisdom of the change, and once convinced they will make the change quickly enough.

Some have tried to drag the race cry into this question. Race has nothing to do with the principle. All French-Canadians are as anxious for good government as English-Canadians, and they will work like brothers for any good cause.

Let them join in a heroic remedy for the present unbearable system. Let us destroy it and erect in its place a system such as I have outlined above. Now is the time to do it.

Very truly yours,

Paul Chomedey.

The estimates to be tabled in the Dominion Parliament will provide for improvements to the St. Lawrence route to the extent of a couple of million dollars. Fifteen high-power dredges will be at work next year, mainly between Montreal and Quebec, and two of them will be the new ones now under construction at Collingwood. The construction of what promises to be the largest dredge in the world will

be tendered for in a few days. The dredge will have a lifting capacity of 1,500 tons of excavation an hour.

"Indian Village" Administration

Montreal, Jan. 22, 1914.

Editor Contract Record:

I heartily agree with your views as expressed in your editorial, "Engineering Responsibilities and Lay Administration." Briefly I may state that I believe the muddling of engineering works in municipal engineering in Montreal and many other cities is due chiefly to the attempt to run large corporation affairs as if they were the affairs of a small Indian village. Every one of the tribe of meddlesome aldermen insists on imposing his views not only in the council chamber but in the field of engineering. The result is that an admirable staff of thoroughly competent engineers is driven to desperation and is so restricted that it cannot order a lead pencil without first explaining the reason and attempting to convince one ignoramus after another.

Given responsibility and authority, Canadian municipal engineers can be trusted to do the right thing, but hampered by the corrupt practices, of a most exasperating nature, which surround them, defeating every honest attempt at efficiency, they are merely machines, no more able to make the grade than a locomotive in the ditch.

Yours faithfully,

R. O. Sweezey.

The Montreal Conduit—Proposed Enquiry

Mr. G. Janin, chief engineer of the city of Montreal, who has been the subject of strong criticism over the break in the water conduit, has asked the Controllers to hold an enquiry. He writes: "The campaign to which the break of the conduit has given rise in the press—and against which, so far, I have had no opportunity to defend myself, tends to ruin my reputation and that of the engineers of the Water Department, while at the same time injuring the reputation of the leading members of the profession who have endorsed the improvements of the aqueduct as we had designed them. Until a decision is taken regarding the inquiry which the public outcry seems to require, my silence might give the impression that I am opposed to such a measure; on the contrary, I consider it to be in my interest and that of my associates that an inquiry be held without delay, in an impartial and thorough manner. Such is my belief and I am writing the Board of Commissioners mentioning my wishes concerning the matter." Mr. Janin is very ill as the result of his exertions supervising the repair of the conduit.

Mr. John R. Freeman, the New York expert engaged by a committee of citizens, has reported on the repair of the conduit. He recommends the plan which is now being carried out to strengthen the conduit and endorses the proposal for an emergency supply from the Lachine Canal. He says that the quickest and cheapest safeguard is a heavy, thick and deep deposit of broken rock placed directly upon the present earth bottom of the cut (water being first pumped out and the ice removed), this rip-rap to lie directly against the present earth slope and by its weight and support prevent further caving or sliding.

Power has been given by the Quebec Legislature to spend two million dollars on the waterworks system.

A Bill is also being promoted for the city of Montreal to take over the system of the Montreal Water and Power Company, a provisional agreement having been made between the directors and the Controllers. The question of price will have to be settled, and it is probable that the citizens will be asked to pass a by-law approving the purchase.

Ontario Reunion of McGill Science Graduates held in Toronto

ON the evening of Saturday, January 17, the Ontario graduates of the Faculty of Applied Science of McGill University, Montreal, held a reunion at the Engineers' Club of Toronto. The meeting was a particularly happy and successful function and was attended by over fifty. The guests of the evening were: Dr. Adams, Dean of the Faculty of Applied Science of McGill University; Dr. Galbraith, Dean of the same faculty at the University of Toronto, and Professors C. H. McLeod and N. N. Evans, of McGill University.

After a pleasing menu had been disposed of and the toast to the King had been duly honored, the chairman, Mr. Willis Chipman, in a happy speech welcomed the graduates and introduced the toast-master, Professor Evans, who discharged the duties of this office most capably. The toast list was as follows:

"Our Alma Mater," proposed by Mr. W. F. Ferrier, B.Sc., and responded to by Dr. F. D. Adams.

"Applied Science," proposed by Mr. J. G. G. Kerry, M.Sc., and responded to by Professor C. H. McLeod.

"Sister Universities," proposed by Major T. Harry Jones, and responded to by Dr. Galbraith.

In proposing "Our Alma Mater," Mr. Ferrier, in an enthusiastic speech, directed the attention of those present to the prominent positions held by graduates of McGill University and showed how their achievements had brought honor to their alma mater. Replying, Dr. Adams reviewed the history of the Engineering Faculty from the time of its formation, showing how it had grown from a small class back in the 60's to a world-renowned institution with the present large attendance of 580. In the early days there were few buildings and less facilities, but now the advantages offered by the Faculty placed McGill in the forefront of engineering schools. Curves had been prepared showing the attendance from 1880 and the rapid increase as shown graphically was very marked. An idea of the cosmopolitan nature of the student body might be gathered from the fact that forty different nations were represented at McGill. The graduates were distributed over the greater part of the inhabited sections of the world and everywhere the name of the University was being upheld by men who were forging ahead in their profession.

An important announcement made by Dr. Adams was that Sir Wm. MacDonald had donated a site of some twenty-seven acres for the erection of new buildings for the University, these to comprise residences, gymnasium and edifices for the various faculties.

Mr. J. G. G. Kerry, in proposing "Applied Science," dealt with the men who were graduates of this faculty, making interesting reference to the achievements of those who stood out most prominently. Professor McLeod's response was along much the same lines as Mr. Kerry's observations and was particularly well received, practically all of those present having sat under Professor McLeod at college.

In proposing the toast, "Sister Universities," Major Jones commented upon the good spirit which existed between the several colleges and expressed gratification in knowing that instead of a feeling of jealousy there was one of friendly rivalry—a feeling which tended to give the students a most efficient and successful training. Dr. Galbraith, who replied, spoke at some length on the proper education of the engineer. A great many people entertained the idea that an engineer should be a master of mathematics and the sciences—a theoretical expert, but this was an erroneous principle. The student should be grounded in the first principles of the sciences

and shown how to apply them. In this way the future engineer would be able to grasp what was required for the solution of any particular problem and would know where to seek and how to apply the necessary knowledge and theory. The main theme of Dr. Galbraith's address was a common-sense, practical education for the engineer.

The toast list completed, Mr. Chipman called upon the assembly to honor the oldest engineering graduate present, Mr. Maurice Gaviller, who responded, giving some interesting reminiscences of his experiences at McGill University in 1861-3. Mr. J. McEvoy then proposed the health of the toast-master, Professor Evans, who replied with characteristic heartiness. Professor Evans' remarks were of particular interest in that they touched upon the work accomplished in connection with the Graduates' Society, an organization designed to keep track of the graduates and maintain a man's university connection by means of bulletins. It may be noted that the onus of the heavy duties involved in this work is borne by Professor Evans, who is honorary secretary. After the thanks of those present had been tendered to the committee in charge of arrangements by Mr. A. R. Davis, and acknowledged by Mr. J. R. Larmonth, a very pleasant evening came to an end. Mr. Willis Chipman came in for considerable congratulation as the proposer of the reunion and as one who had been particularly active in bringing the idea to a successful consummation.

The personnel of the committee was as follows: Mr. Willis Chipman, chairman; Messrs. W. F. Ferrier, J. McEvoy, A. L. Mudge, J. H. Larmonth, E. R. Clarke, H. G. Nicholls and M. J. McHenry (secretary).

Annual Meeting of Toronto Branch C.S.C.E.

THE annual meeting of the Toronto Branch of the Canadian Society of Civil Engineers was held in the lecture room of the Engineers' Club on January 21, under the presidency of Mr. E. A. James. The Secretary-Treasurer, Mr. A. B. Garrow, submitted a report which showed a cash balance of \$877.50, a considerable portion of which is to be expended in the enlargement of the already extensive library belonging to the Branch.

The election of officers for the year resulted as follows: Mr. A. F. Stewart, Chairman; Mr. J. Galbraith, Jr., Secretary-Treasurer; Messrs. J. G. G. Kerry and C. H. Mitchell, and Prof. Gillespie, members of the executive committee.

Mr. Kerry was chosen to represent District 5 on the Nominating Committee of the Society. The meeting adjourned after tendering a vote of thanks to the retiring chairman.

Annual Meeting of the Canadian Society

The 28th annual meeting of the Canadian Society of Civil Engineers is now being held at Montreal. The dates of the meeting are January 27-29. It is the first time that a general convention has been held in the Society's new buildings on Mansfield street, Montreal. The retiring president of the society is Mr. Phelps Johnson, head of the St. Lawrence Bridge Company, and the president-elect is Mr. M. J. Butler, executive head of Messrs. Armstrong, Whitworth of Canada, Limited. Mr. Butler will be remembered as the former General Manager of the Dominion Steel Corporation and previously Deputy Minister and Chief Engineer of the Department of Railways and Canals of the Dominion Government. The nominees for vice-president are Mr. R. A. Ross, of Montreal, and Mr. A. F. Stewart, of Toronto.

Engineering Progress at Nanaimo, B. C.

DESPITE the money stringency and unsatisfactory labor conditions locally, which handicapped operations during the latter part of the year, 1913 witnessed great progress in the Works Department at Nanaimo, B.C., which is under the supervision of Mr. S. Barlow Bennett, City Engineer. A copy of Mr. Bennett's report, which has just reached us, contains much of interest in regard to the activities of the year at Nanaimo. One of the important undertakings of the year carried to successful completion was the construction of an 18-in. wooden water-main, together with the general improvement of the distribution system of the district. An illustrated description of this undertaking was published in our issue of December 24, 1913. The work entailed an expenditure of \$22,514. The total length of 18-in. diameter pipe laid from No. 1 dam to the city was 10,800 ft., the pipe being supplied by the Dominion Wood Pipe Company, Limited, New Westminster, B.C.

In regard to the maintenance and operation of the water supply, Mr. Bennett deplors the waste of water and advises



Mr. S. Barlow Bennett, City Engineer of Nanaimo, B. C.

the installation of meters. In this connection Mr. Bennett's suggestion might be taken in conjunction with a reading of the article, "The Economics of the Water Meter," published in our last issue.

In the department of street paving, Mr. Bennett's force was particularly active during 1914, plans, profiles and specifications having been prepared for upwards of 99,000 square yards of pavement. It is hoped that at an early date the paving of the important streets of the city will be an accomplished fact, actual operations not having been commenced last year owing mainly to unsatisfactory labor conditions. The prices submitted for paving were: 4-in. concrete base, with 2-in. asphaltic top, \$185,753, and for 5-in. concrete base, with 2-in. asphaltic top, \$200,258. The total mileage of sidewalks laid is 18.

The Newcastle townsite sewerage scheme, upon which operations were suspended during the winter of 1912 owing to heavy snow-falls, was re-commenced the latter part of January. The laying of an additional 5,000 ft. of vitrified earthenware pipe, together with 800 ft. of 12-in. cast-iron pipe for the outfall completed the system by the latter part of May. The total cost was approximately \$16,000. Mr. Bennett regards the average cost of \$1.48 a foot as very satisfactory taking into consideration local conditions.

During 1913, 10,100 ft. of sewers were laid. The total amount of sewers now laid at Nanaimo is 55,632 ft., or about

10.5 miles. The whole of the work undertaken by the Sewers Committee has been carried out by day labor.

Increased activity is noticed in the Building Department, which also comes under the supervision of the City Engineer. The preparation of a building by-law is recommended in Mr. Bennett's report.

An Amendment to the Saskatchewan Public Health Act

At the recent session of the Saskatchewan Legislative Assembly, there was passed an amendment which will prove of interest and advantage to municipalities in that province contemplating the establishment or extension of public health works and to engineers acting for such municipalities.

The Public Health Act of Saskatchewan is frequently referred to as providing perhaps the most advanced legislation in regard to waterworks, sewerage and sewage disposal control.

Prior to the passing of the amendment, the Act required that complete plans and specifications of all waterworks, sewerage or sewage disposal systems or extensions should be submitted to the Commissioner of Public Health and his certificate of approval obtained before any by-law for the purpose of raising money for such works could be submitted to the votes of the electors; and further, that no debentures would be valid if issued under any by-law passed in contravention of such requirements.

The Commissioner has received the hearty co-operation of the various municipalities in the administration of the Act, but he has noted that in some cases, particularly in the smaller towns, the preparation and submission of complete plans and specifications, previous to the passing of the by-law, was a matter which called for re-consideration, because of the following circumstances:

(1) A municipal council taking up office in January required some six weeks in which to formulate the constructional programme for the year. The engineer, on receiving his instructions, proceeded with the preparation of plans and specifications, which occupied at least two months. These plans and specifications were submitted to the Commissioner of Public Health during the month of April and assuming that they were satisfactory to the Commissioner, the by-law could not be voted upon until it had been advertised for three successive weeks. Thus the electors did not vote until about June 1st, and the necessary procedure following the passing of the by-law usually delayed the letting of contracts until the constructional season was far advanced.

(2) Consulting engineers engaged by municipalities of necessity had to incur considerable expenditure in rushing the preparation of detailed plans and specifications, for which remuneration was not forthcoming in many cases until the debentures were sold.

(3) There was a possibility of the by-law being opposed by a majority of the ratepayers, in which case the preparation of the details of the scheme meant unnecessary expense to the municipality.

The difficulties raised will be met by the new amendment, wherein it is required that a report, general plans and such information as may be required to allow of a general understanding of the proposed system or extension may be submitted and a provisional certificate issued by the Commissioner, which will be sufficient for the purposes of the by-law.

No debentures, however, will be valid until the complete plans and specifications of the system have been submitted and approved.

There will shortly be issued from the Bureau of Health regulations stating definitely what form the various plans and data necessary for the provisional and final certificates shall take.

Annual Meeting London Builders' Exchange

At the annual meeting of the Builders' Exchange of London, Ont., held under the presidency of Mr. L. H. Martyn in the rooms of the association in the Bank of Nova Scotia Building on Monday, January 19, the following officers were elected: President, Mr. T. R. Wright; First Vice-President, Mr. E. R. Dennis; Second Vice-President, Mr. A. Nobbs; Secretary-Treasurer, Mr. F. S. Barclay. Auditors: Messrs. J. Whittaker and E. Gerry. Board of Directors: Messrs. T. R. Wright, E. R. Dennis, A. Nobbs, L. H. Martyn, Geo. S. Gould, L. R. Folley, W. T. Pace, F. G. Tulett and Geo. H. Haney. The association made rapid strides in every department during the last twelve months and 1913 passed into history as the most successful year in the records of the Exchange.

Personal Mention

Mr. Isidore Feldman is going into architectural practice in new quarters at 44 Adelaide street west, Toronto.

Mr. H. A. Brazier, assistant city engineer of London, Ont., has returned from a short trip to the Old Country.

Mr. William H. Connell, Chief of the Bureau of Highways and Street Cleaning, Philadelphia, Pa., recently delivered an illustrated lecture, "Organization and Methods of Street Cleaning Departments" before the Graduate Students in Highway Engineering at Columbia University.

Sir William Willcocks, the English engineer who designed the Assouan Dam and who is in charge of British irrigation and drainage works in the East, will deliver an address on "River Regulation and Control in Antiquity" at the fourth National Drainage Congress at Savannah, Ga., April 22.

Mr. Charles H. Egleo, for nine years General Manager of the Ambursen Hydraulic Construction Company, in charge of their construction work, has just become connected with the Aberthaw Construction Company of Boston, and will have charge of all dam and reservoir work for this company.

Mr. P. B. McGinnis, who takes the place of Mr. W. B. Rawson as Construction Engineer for the Canada Cement Company, has taken up his duties at Medicine Hat. He has been connected with the company at Winnipeg and will have full charge of the construction work until the completion of the plant.

The Tuec Stationary Air-Cleaning System

From Mr. Jas. J. Martindale, Ontario representative for the TUEC stationary air-cleaning system, we have received a copy of an artistic, informative publication devoted to an explanation of the principles of the TUEC apparatus and an enumeration of its various applications.

The TUEC system has made rapid strides since its first introduction into Canada a few years ago. It has become famous by virtue of its sanitary character, its efficiency and durability, its simplicity of construction and its low operating cost. TUEC installations have been placed in some of the finest buildings of all types erected in recent years. These are illustrated in the booklet under discussion, complete sections being set apart for photographic reproductions of costly residences, private dwellings, churches, cathedrals, apartment and flat buildings, public buildings and educational institutions, hotels, commercial and office buildings, and so on. It is interesting to note that Canada figures prominently in some of the best of these installations.

The International Joint Commission heard arguments at Washington on January 13 against granting authority to

the city of Winnipeg to obtain its water supply from the Lake of the Woods which has a water-shed of some twenty-six thousand square miles in the United States and the Dominion. Both the Canadian and United States governments have assented to the Winnipeg water project, but under the treaty the commission has the right to over-rule these decisions if it finds the plan detrimental to boundary waters or to the people residing near by. Objection was made to Winnipeg's request by representatives of the city of Kenora, at the mouth of the Lake of the Woods, on the ground that their municipal plant would be injured if Winnipeg were allowed to tap the lake. The commission have extended until February 24 the time for hearing arguments on the application of the Michigan Power Company to continue its diversion to the waters of St. Mary's River at Sault Ste. Marie.

New Motor Street Watering Carts

Messrs. Leyland Motors Limited, Leyland, Lancs., Eng., recently completed for the city of Nottingham two motor street-watering carts with interchangeable refuse bodies. One of these carts is shown in the accompanying illustration. These carts are wonderfully efficient and of an entirely new design. The water, instead of being spread by gravity over a width of road from twelve to fifteen feet, is delivered by pressure produced by placing a turbine pump between the tank and the nozzles. As a result, pressures can be obtained up to



Type of motor street-watering cart used by the city of Nottingham.

fifty pounds, and roads varying in width up to fifty feet can be watered. With separate nozzles, asphalt paving and wood block roads can be thoroughly scoured and washed. The pump can also be used for filling the tank from a river or canal, this being effected by an arrangement of valves. It is valuable as a means of first aid in the case of small fires as it will throw a jet of water to the top of a three-storey building and enough water is carried to put out a fire of considerable proportions. In case of emergency, this motor watering cart can be run at a speed of twenty miles an hour.

In an article relating to constructional work at Port Arthur published in our issue of December 31 it was stated that quite a colony of "wooden" residences had sprung up at Ray Park. This was a typographical error and should have been rendered "modern." The error was pointed out to us by Mr. H. S. H. Goodier, Secretary of the Port Arthur Board of Trade, who states that since the publication of the article word has reached him of further prospective developments in Mariday Park, in which more than \$600,000 will be spent on residence work in 1914. This sub-division is owned by Mr. J. J. Carrick, M.P.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The Elder Ebano Asphalt Company, Limited, Montreal, has declared a dividend of 6 per cent.

The Mines Branch of the Department of Mines has installed at Ottawa a modern and well-equipped laboratory for the purpose of experimental concentration and metallurgical tests with Canadian ores and minerals.

The Woodstock, Ont., Board of Works have decided to ask the council's permission to advertise for an engineer to take full charge of the city's streets and to combine the work of street commissioner with that of surveying and civil engineering.

A new sewerage system at Weston, Ont., is about to be completed, the only remaining work being a small portion of the storm sewer, which must be constructed over private property. The Resident Engineer, Mr. Hicks, is in charge of the work.

Plans for the new Gerrard street bridge, with a recommendation that the estimate of \$382,000 be accepted, were submitted to the Toronto Board of Control recently by Mr. Harris, Commissioner of Works. This design would give a 66-foot width and carry 40-foot cars.

An interesting paper, "Sewage and Sewage Disposal," was read before members of the Port Arthur board of trade recently by Mr. L. M. Jones, city engineer. Mr. Jones dealt with the question of plans for sewers and drainage and discussed several suggested improvements for the city.

A deputation from the Toronto city council waited upon government ministers recently and urged the desirability of starting preliminary work on the various public buildings decided upon for Toronto. These works include the new Post Office, Customs House and harbor improvements.

A report from Fredericton, N.B., states that the Inter-colonial Railway have made extensive development plans, which include the construction of a modern station at Fredericton. A freight warehouse, roundhouse, machine shops and yards are also to be built by the company.

The Toronto City Solicitor has obtained the approval of the Board of Control to sue a number of defaulting contractors for the difference between the price of the original contract and the cost of the new one in cases where they have declined to execute the contracts taken out.

It is predicted by architects in London, Ont., that building on a large scale will open up in that city during the spring. Work will be commenced on the new post office in the next few months and a rumor is current that a Toronto firm is contemplating the erection in that city of a new warehouse or a retail store.

The low-level pumping station at Montreal is to be fire-proofed in order to comply with restrictions laid down by the fire underwriters. The floors of the buildings, which house a total pumping capacity of sixty million gallons daily, will be laid in concrete and a fire-wall be built on the west side of the boiler house.

A report from Ottawa announces that the government will erect a \$300,000 building for the purpose of housing a first-class display of the natural products of the Dominion at

the forthcoming Panama Exhibition. Each of the big Canadian railways will also erect a building for the accommodation of their individual exhibits.

The Canadian Connecticut Cotton Mills, Limited, has practically completed its large plant at Sherbrooke, Que., which is expected to be in operation early in February. The company will manufacture tire fabric exclusively and is said to have disposed of its entire output to four of the largest Canadian tire manufacturing companies.

A new highway, 224 miles long, connecting Augusta, Me., and the city of Quebec, is assured, according to an announcement by the State Highway Commission of Portland, Me. The Quebec government has appropriated \$300,000 to build the road from Quebec to the Maine boundary, a distance of 93 miles, and the remaining 131 miles will be constructed by the State of Maine.

The specifications of the proposed dam on the St. Maurice River, P.Q., have been prepared by the Running Waters Commission. The object is to provide an even flow of water for industrial purposes, and make possible the development of a very large amount of horse-power. The dam is to be constructed above La Loutre Rapids, four miles above the mouth of the Wabane River, and will be 1,720 feet long.

The engineers of the city of Montreal are at work on a report which will recommend the immediate construction of subways and new surface lines in order to improve transportation facilities. According to information given out, the report will advise the construction of three subways, one running east and west, another north and south, and a third in the business section. The subways will allow for sewers and conduits to be laid in them.

The St. Agathe Lumber & Construction Company, Limited, incorporated recently by federal charter with a capital of \$300,000, contemplate the erection of a factory at St. Agathe des Monts, Que., for the manufacture of cement products. They will also erect a plant for the production of lumber, doors, sash, flooring and other products. The officers of the concern are: president, Mr. L. E. Parent; vice-president, Mr. J. B. Reid; director, Mr. F. Forget; secretary-treasurer, Mr. E. Parent.

Now that the final draft of the proposed new building by-law for Hamilton is ready for adoption by the city council, objections are being raised on all sides, one of the most important being in regard to the provision requiring all buildings erected in the central part of the city to be of fireproof construction. At a meeting of the Board of Control at which the matter was discussed, the Mayor expressed the opinion that such a provision would about double the cost of building construction in that part of the city. The by-law is at present in the hands of the City Solicitor.

Announcement is made from Ottawa that contracts for the new public buildings at the capital will be awarded in the spring of 1915. The time for the reception of preliminary designs, which was originally fixed for January 2 of this year, has been extended to April 2. The new buildings are to be fireproof throughout, and will be designed to provide a superficial office area of 500,000 square feet. It is expected that the buildings will take two years and a half to complete, and the

cost will run into millions. When these and the new Customs buildings on Sussex street are completed there will be a continuous line of government buildings for more than a mile.

The Dominion Government has cancelled the contract of Messrs. Connolly & Charleson, who were erecting new steamship berths at West St. John, N.B., and announces that other steps will be taken to hasten this work, in order that at least two more steamship berths may be available for use next winter. The Government is also considering a request of the city council that two steamship berths, each about eight hundred feet long be constructed on the east side of the harbour near its mouth and convenient to the large sugar refinery, on which construction work is now well advanced. More wharves are needed on the east side of the harbour to meet the growing demands of the traffic of the port, and if the Government regards the city's request favorably there will be great activity in construction work on both sides of the present harbour, in addition to the great work in progress in Courtenay Bay.

On the south side of the Gulf of St. Lawrence, the St. Lawrence Pulp & Lumber Corporation is erecting a big plant which when finished will represent an investment of close to a million dollars. There is an irregular group of buildings, mostly one-storey and measuring something like 900 by 200 feet in plan, forming a complete pulp mill for making high-grade bleached sulphite pulp, together with a digester building covering digesters reaching 160 feet above ground. All this is now being built by the Aberthaw Construction Company of Boston, and is to be finished by next September. The buildings have concrete exterior, the interior structure being largely of structural steel with yellow pine roofs. A private railroad is to supply the mill with logs from the extensive timber and pulp wood limits of the company, aggregating some 500 square miles. The Dominion Government has undertaken to develop a harbor for safe wharfage for ships up to 6,000 tons.

An agreement has been made between the St. John Railway Company and the municipal council for the extension of the company's line three miles to Coldbrook, where an industrial suburb is being developed. There is already an automobile factory at Coldbrook and arrangements have been completed to erect a nail factory. There is talk of a company establishing a shoe factory there, and the Coldbrook Realty and Development Company will continue its work of making a garden suburb. The street railway company has already undertaken to extend its line through East St. John, in the opposite direction from Coldbrook, to a point at Little River, just beyond the works at Courtenay Bay. During the present year, also, the bridge will be completed between East and West St. John, this enabling the company to conduct an uninterrupted service to West St. John and Fairville. The people of the latter place are petitioning the company to extend its line in that locality as a factor in suburban development. The Suburban Railway Company, which was unable to carry out any of its plans last year, hopes to secure a renewal of its charter and begin construction work this year.

The Browning Company, Cleveland, Ohio, are issuing copies of an excellent catalogue of locomotive cranes. The outside dimensions of this publication are 12 ins. x 9 ins. and the half-tone illustrations, two on a page throughout, are of sufficient size to illustrate the work to the best possible advantage. Browning locomotive cranes have been used on some of the largest constructional undertakings in the world. They came into favorable prominence on the Panama Canal construction, and a single instance of the kind of construction upon which they are figuring in Canada is the extensive harbor work now in progress at St. John, N.B. These cranes can be equipped to handle a hook block, an electric lifting

magnet, an automatic bucket of any type, a drag scraper bucket, a steam shovel dipper, or pile driver hammer and leads. Any and all of these are quickly interchangeable with the others, thus giving the owner an all-round machine. The catalogue illustrates and describes a few of the more important details of construction, as well as some of the many uses to which Browning cranes and their various attachments are adapted.

WESTERN CANADA

A brick-making plant has been established at Meyronne, Sask., and will begin operations in the spring.

A large number of contractors have submitted tenders for the erection of the block which the Hudson's Bay Company proposes to erect in Victoria, B.C., on the site at present being excavated by Messrs. Luney Brothers.

Under the terms of an act to encourage housing accommodation in cities and towns, the Manitoba legislature is to empower city and town municipalities to guarantee securities issued for the purpose of building houses of moderate size.

The Regina General Hospital Board has requested the city council to prepare and submit to the ratepayers a by-law granting the necessary permission to raise \$175,000 to complete a number of municipal contracts, including a Nurses' Home.

Mr. Southwick, of Vernon, B.C., is reported to have disposed of patents in five countries for his Pressure Water Meter which has been taken up by a syndicate of Vancouver men. This invention is said to work on any water-pipe, even a large three-foot main.

The Mayor of Vancouver has announced that competitive plans will probably be invited for the new city hall and a money by-law put before the electors next January. If this is carried out the new city hall will probably be in course of erection before the end of the year.

Rapid progress is being made on the new million-dollar Law Courts under construction by the National Construction Company at Winnipeg. The contractors are further advanced than they expected to be owing to the unusually favorable weather for building which has prevailed so far this winter.

Hon. Price Ellison, Minister of Finance and Agriculture, formally opened one of the most up-to-date public schools in the interior of the province at Kelowna a few days ago. The school, which involved an outlay of \$85,000, is a massive brick and concrete structure designed by Mr. Geo. E. Nobles, of Lethbridge.

The Saskatoon Builders' Exchange, at a special meeting on January 12, passed a resolution expressing the conviction that the proposed law requiring employers of labor to pay in cash or marked cheques every seven days would be impracticable and work a hardship on many in the present financial depression.

Mr. Richard Obee, Secretary of the Board of Trade, Vernon, B.C., has had a communication from an eastern manufacturer who proposes starting a factory in that district for the manufacture of hollow-tile and other clay products. Already samples of clay available in Vernon have been analysed with satisfactory results.

The Canadian Mineral Rubber Company intend proceeding with their large contracts for local improvement in Victoria, B.C. This portion of the work affects some eighteen streets and calls for about 100,000 cubic yards of material, or about \$350,000 worth of work. The intention is to proceed with the work gradually during the year.

The announcement was made in Calgary recently that work on Calgary's million-dollar post office would be com-

menced at once, that Federal engineers were in the city to select a site for an international elevator, estimated to cost one million dollars, and that the contract for the new three million-dollar armoury would be let in the course of a few months.

The Building Inspectors' report to the Kelowna, B.C., city council discloses the fact that the building permits for the twelve months show an increase of fifty per cent., as compared with 1912. The Kelowna Growers' exchange have under consideration the establishment of various plants to handle the by-products of the valley.

A report on the Coquitlam, B.C., dam and city water supply has been presented to Mr. J. B. Challies, Superintendent of the Water Power branch, by Mr. J. R. Freeman, Consulting Engineer for the Dominion Government. Mr. Freeman dealt with the purity of the water supplied from the lake, the stability of the dam, spillway and sluice gates and the area of reservation.

With the object of inducing the Dominion Government to give a preference to local contractors in awarding contracts for government buildings, the Calgary Builders' Exchange at their annual meeting on January 14 endorsed the stand taken by the local board of trade in connection with this matter. The members seemed to think that in the awarding of local contracts they had not been given fair consideration in the past.

Preliminary plans and specifications drawn by the Canadian Stewart Company, of Montreal and Toronto, for a large grain elevator at Port Nelson, the northern terminus of the Hudson Bay Railway, have been approved by the Dominion Government. The elevator will be thoroughly modern and capable of holding several million bushels. The contract will be let in the spring so that the elevator may be ready for use by the time the railway reaches the port. Some fifteen companies are said to have submitted plans.

A new theatre for the Victoria Opera House Company Limited, has recently been erected by Messrs. Penner & MacLellan, general contractors, at Victoria. The building is said to have been completed within sixty days, which is probably a record for large buildings on the Pacific coast. The framework was designed by Mr. H. Bittman, steel engineer, the architects being Messrs. Rochford & Sankey. The main truss holding the balcony is of an entirely new type, and the ornamentation of the interior follows the Louis XVI. period throughout.

One of the most important works which has engaged the engineering department in Victoria, during the past year is said to be the Sooke water works. In spite of difficulties the contract for the concrete floor laying has been awarded and the city will shortly commence the construction of the riveted steel plate while the balance of the work is under way. By the appropriation of another million and a half dollars the public has reiterated its approval of the scheme, but the latest proposal to acquire the Leach River water-shed at a greatly reduced price has been negated.

An act to establish public irrigation corporations throughout the province of British Columbia will be introduced by the Hon. Wm. R. Ross, Minister of Lands, at the coming session of the legislature. It will make possible the joint ownership and corporate controlling of irrigation enterprises by the land owners of any locality, where the lands can be irrigated advantageously from a common source of supply or through a common system of works. A petition for incorporation under the Act must be addressed to the Lieutenant-Governor-in-Council, and filed with the Controller of Water Rights.

Mr. Bowser, Attorney-General for British Columbia, has announced that the Pacific Great Eastern Railway interests

have been negotiating for some time with the Provincial Government over the closing of the fore-shore rights in connection with the proposed terminals at Newport. The company is said to claim absolute right to the fore-shore, and the Dominion Government and the Pacific Great Eastern practically came to an agreement, but the latter has yet to conclude terms with the provincial authorities. It is said that the Pacific Great Eastern will spend \$2,000,000 in harbor improvements at Newport.

The proposal of the Industrial Bureau of Winnipeg to establish manufacturing buildings in a series of units on a portion of the old exhibition grounds, is likely to prove successful, judging from an announcement made by Mr. Chas. F. Roland that all preliminaries for the financing of the \$1,000,000 worth of industrial bonds has been practically completed. The site and plans submitted are looked upon by the underwriters as being well thought out to meet a needed want in Winnipeg for economical manufacturing. The scheme, it is said, will afford small concerns with limited capital a better opportunity of getting a foothold, while at the same time catering to the growing trade which is developing in the prairie provinces.

When the new arch bridge at Saskatoon is completed next year, the city will have probably the largest reinforced concrete structure of the kind in Canada. The bridge will span the Saskatchewan River at the intersection of 25th street and Spadina Crescent. The total length of the bridge and retaining walls at its approaches will be about 1,490 ft., the width being 65 ft. The arches, of 150 ft., will be longer in span than any other in the Dominion. Two 8-ft. sidewalks are to be cantilevered from the roadway, while provision is made for two street car tracks and two 14-ft. roadways making ample room for each section. The bridge was designed for a temperature ranging from 50 degrees below zero to 90 degrees above. Under the terms of agreement the city is to pay one-third and the Provincial Government two-thirds of the cost of the structure.

One million dollars was the approximate cost of improvements made by the British Columbia Telephone Company during 1913. These improvements included work in the territory of practically every exchange the company operates, from the west coast of Vancouver Island to the eastern extremity of the Lower Mainland, at Kamloops in the middle interior, and in the Kootenay and Boundary districts. The principal piece of construction was the laying of the direct submarine cable to Vancouver Island from Point Grey, on the mainland. During 1913 new exchanges were erected at Fraser, a suburb of Vancouver, and at Port Coquitlam. Work was inaugurated on the new eight-storey central office building on Seymour street, Vancouver, in which provision will be made for three exchanges. The steel frame work of this building is approaching completion.

A new bulletin on jaw crushers received from Messrs. Canadian Allis-Chalmers Company, Limited, contains some interesting details appertaining to the construction and operation of this equipment. The various types of the company's products are illustrated and the application explained carefully.

Alabastine Hardmortar, Limited, Toronto, have removed their office from 123 Bay street to the corner of Jarvis and Esplanade, where they have opened a warehouse. The firm will thus be more centrally located and their having a warehouse at that point will enable them to handle small orders promptly and at the same time cut down their delivery prices. The manager is Mr. O. A. Cole.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aylmer, Que.

A by-law has been passed by the rate-payers authorizing the extension of the intake pipe by 2,000 feet, at an estimated cost of \$15,000.

The by-law providing for certain concrete sidewalks at a cost of \$8,000, was defeated by the ratepayers.

Amherst, N.S.

The town council is considering the laying of permanent roads in various parts of the town. Clerk, W. F. Donkin.

Bassano, Alta.

Tenders addressed to the town council, Sec.-Treas., Geo. B. R. Bond, will be received until Feb. 9th for all labor and material, except filter distributors, for the construction of sewage disposal works, consisting of tank and filter and relative works.

Brantford, Ont.

The Board of Works will make an application to the Railway Board of Canada for the construction of subways, one at Grey Street Crossing and the other at St. Paul's Ave. Clerk, H. F. Leonard

Brome, Que.

A by-law has been passed by the rate-payers to raise the necessary funds to construct 20 miles of macadam roadway in Brome Twp.; the matter will be further discussed at council meeting Feb. 2. Mayor, M. E. Bullard.

Camrose, Alta.

The municipal council is considering the construction of a sewer to the New Normal School and also one to the hospital.

Hull, Que.

J. A. Laforest, the City Engineer, reports that an auxiliary pump is required in addition to the present waterworks equipment at the pump house. To be driven either by electricity or water power. Capacity 6,000,000 gallons daily. The cost is estimated at \$20,000.

Knowlton, Que.

The municipal council has purchased additional property for extension to water system in the spring. Clerk, J. E. Fay.

London, Ont.

The city council has had plans drawn for the construction of a 42-in. tile pipe storm sewer on Colborne street, from River to Queen's Ave. Engineer, W. N. Ashplant.

The city council has under consideration the laying of cement, gravel and macadam roadways in various parts of the city at an estimated cost of \$15,000.

Medicine Hat, Alta.

The city engineer having recommended the construction of a sewer pumping

station on Balmoral St., at an estimated cost of \$10,000, tenders for outside piping will be called for at once. Council clerk, H. Baker.

Ottawa, Ont.

Specifications are being prepared and tenders will be called shortly for brass goods and castings required by the waterworks department.

The Waterworks Dept. is preparing specifications for the supply of lead pipe for 1914 and tenders will be called shortly. City Engineer, Arch. Currie.

The City Council will shortly call tenders for the supply of hydrants for 1914.

The city council has had plans drawn for asphalt pavement on Water St. between Cumberland St. and King Edward Ave., estimated cost \$5,000; and macadam roadway, with tarvia finish on Sweetland Ave., between Osgoode and Somerset Sts., estimated cost \$4,000.

Province of Ontario.

The locations of G. T. P. stations at Reba, Sowden and Unaka have been approved.

Regina, Sask.

Filter bed, \$35,000.

The City Council has under consideration the construction of an additional filter bed at Regina Sewage Disposal Works. Material required, steel and sheeting for roofing, concrete blocks, cement, gravel, field boulders, pipe and valves. City Engineer, F. McArthur.

Stratford, Ont.

The City Council has received from the Board of Works a recommendation that sewers be constructed on McNab, Norfolk and Laurier streets, and on lane in Avalon Park, estimated cost \$2,277.50; 9-in. and 12-in. pipe to be used.

Sarnia, Ont.

The contract for the laying of the sewer on Clifford St. has been awarded by the Town Council to Patrick Corrigan & Company.

The town council is considering the purchase of road machinery. Chairman Board of Works, Dr. Henderson.

Toronto, Ont.

An estimate has been prepared for widening Kenilworth Cres. to 50 ft. for 550 ft. on west side and 1150 ft. on east side, \$12,750.

Commissioner of Works, R. C. Harris, recommends the laying of tile pipe sewers on 12 lanes, estimated cost \$20,880.

The Board of Control has under consideration the laying of brick block pavements on Front St. E., Overend and Tate Sts., at an estimated cost of \$15,286. Commr. of Works, R. C. Harris.

The Board of Control has under consideration the laying of a sewer on Blackburn St., from Gerrard St. to Mt. Stephen St., estimated cost \$1,760.

The Board of Control has under con-

sideration grading on Harrison, Roxton Road and Wheeler Ave., estimated cost \$33,465.

Winnipeg, Man.

Tenders addressed to S. H. Reynolds, Chairman of the Commissioners Greater Winnipeg Water Dist., 901 Boyd Bldg., will be received until Feb. 11th for the clearing of 1,800 acres right-of-way, 5 frame buildings, supply of tools and material (except ties, rails, etc.) for building and laying of tracks, distance 85 miles, also supply of tools and material, except poles, for the building of telephone line between Shoal Lake and Transcona, 8,500 tons of 60-lb., new or relaying rails, 400 tons angle bars, 256 tons bolts and spikes, 20 frogs and switch stands. Plans and specifications may be seen at the office, 901 Boyd Bldg., Winnipeg.

The Board of Control has under consideration the laying of sewers in Cameron St., \$790, and Beach Ave., \$630, and granolithic walks on Florence Ave., \$335; Simcoe St., \$537; Beverley St., \$498; Richard Ave., \$481; Ingersoll St., \$1,736; McGee St., \$1,205; Agnes St., \$1,716; Maryland St., \$421. Engineer, H. N. Rutan, 223 James Ave.

Railroads, Bridges and Wharves

Ottawa, Ont.

The City Engineer has received instructions from the Board of Control to commence work on the Bank street bridge.

Province of B.C.

The G. T. P. Rly. has been authorized to construct bridge across Stoney Creek, mileage 397.1, Prince Rupert E.

Lake Megantic, Que.

The tenders received for the construction of the dam being considered unsatisfactory the town council will call new tenders in about a month's time. Engineer-in-charge, Ed. A. Evans, 92 St. Peter St., Quebec.

Province of Alberta.

The Canadian Northern Alberta Ry. has been authorized to construct bridge across Stony River, Sec. 35-48-28, w.5.m. Alta. Mileage 209.3.

CONTRACTS AWARDED

Kaslo, B.C.

The wharf contract has been awarded by the Public Works Dept. to Wm. English, Kaslo.

Montreal, Que.

The contract has been awarded by the Govt. Dept. of Railways and Canals to Westmount Plumbing & Heating Co., 4278 St. Catherine St., for roofing St. Gabriel Shed No. 1, on Ottawa St.

Vancouver, B.C.

A contract has been awarded by the Great Northern Railway Co. to Canadian Northwest Steel Co., Ltd., Prince

(Continued on page 37)

Tenders and For Sale Department

TOWN OF KERROBERT PROVINCE OF SASKATCHEWAN

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer until 2 p.m. on **Saturday, February 28th, 1914**, for the following works:—

- Contract A.—Laying Watermains (approximately 3 miles).
- Contract B.—Pump House.
- Contract C.—(1) Steel Water Tower.
- Contract C.—(2) Foundation of Water Tower.
- Contract C.—(3) Housing of Steel Water Tower.
- Contract D.—Water Pipes and Specials.
- Contract E.—Valves and Hydrants.
- Contract G.—Pumping Machinery.
- Contract I.—Well and Galleries.

Plans and specifications may be seen at Kerrobert, Sask., or at the offices of the Engineers on and after February 2nd, 1914.

The lowest or any tender not necessarily accepted.

AARON REED, Esq., Mayor.

J. W. LAUMAN, Sec.-Treasurer.

CHIPMAN & POWER Consulting Engrs.
Winnipeg and Toronto.

15



Sealed tenders addressed to the undersigned, and endorsed "Tender for Construction of a 15-inch Hydraulic Self-Propelling Steel Suction Dredge," will be received at this office until 4 p.m. on **Tuesday, March 3, 1914**, for the construction of a 15-inch Hydraulic Self-Propelling Steel Suction Dredge.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of T. H. Schwitzer, Esq., Mech. Superintendent, Birks Building, Ottawa, Ont.; J. L. Nelson, Esq., Supt. of Dredges, Vancouver, B.C.; J. S. MacLachlan, Esq., District Engineer, Victoria, B.C.; C. C. Worsfold, Esq., District Engineer, New Westminster, B.C.; J. G. Sing, Esq., District Engineer Toronto, Ont.; Collectors of Customs at Kingston and Collingwood, Ont., and A. E. Dubuc, Esq., District Engineer, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,

Secretary.

Department of Public Works,
Ottawa, January 20, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51193.

4-5

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent., an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929, Contract Record, Toronto. 53-12

GREATER WINNIPEG WATER DISTRICT

To Contractors

Tenders for Railway and Telephone Construction

Sealed tenders, marked "Tender for Railway Construction" or "Tender for Telephone Line Construction," addressed to Commissioners, Greater Winnipeg Water District, 901 Boyd Building, Winnipeg, will be received up to noon of **Wednesday, February 11, 1914**, for the supply of all tools and material except ties, rails and sundry steel and for the building of grade and laying of track for 85 miles, more or less, of Standard Gauge Railway; also for the supply of tools and materials except poles and for the building of a Telephone Line between Shoal Lake and Transcona.

Information for bidders, specifications and form of tender will be on view and obtainable at office of Commission after Monday, January 26.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,

Chairman of Commissioners.

Winnipeg, Jan. 21, 1914,

4-5

GREATER WINNIPEG WATER DISTRICT

To Supply Men and Manufacturers

Tenders for Steel Rails and for Track Sundries

Sealed tenders, marked "Tender for Rails and Angle Bars," or "Tender for Track Sundries," addressed to Commissioners of Greater Winnipeg Water District, 901 Boyd Building, Winnipeg, will be received up to noon of **Wednesday, February 11, 1914**, for

8500 tons of 60 lb. New or Relaying Rails.

400 tons of Angle Bars.

256 tons of Bolts and Spikes.

20 Frogs and Switch Stands.

Information for bidders, specifications and form of tender will be on view and obtainable at office of Commission after Monday, January 26.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,

Chairman of Commission.

4-5
Winnipeg, Jan. 21, 1914.

Good Opportunity to Importers of Waste and Steels

Firms interested in above write

British Manufacturers' Association, Limited
803 McGill Building, Montreal 2-34



Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, February 3rd, 1914**, for the construction of the following works, viz:—

SEWERS

Coxwell Ave., from Gerrard St. E. to Danforth Ave.

Christie St. Storm Overflow Sewer, Barton Ave. to C. P. R.

West Toronto Division No. 2 Outlet from Annette St. and Western Ave. to Pelham Ave., from Laughton Ave., via Western Ave., Dundas St., Watkinson Ave., G. T. R. and C. P. R. Right-of-way, Osler St. and Pelham Ave.

Ossington Ave. and Hallam St. Storm Overflow Sewer, from Ossington Ave. and Manchester Ave. to Hallam St., and Dovercourt Rd., via Ossington Ave. and Hallam Street.

Waverley Rd. from North Limit, Lot No. 48, Plan M-252 to S.S. Kingston Rd.

Bellefair Ave. 1435 ft. N. of N.S. Queen St. to N.S. Pinehurst Ave.

Wheeler Ave. from 1410 ft. N. of N.S. Queen St. to North End.

Lee Ave. from 1568 ft. N. of N.S. Queen St. to S.S. Kingston Rd.

Kenilworth Ave., 277 ft. S. of S.S. Norway Pl. to S.S. Kingston Rd.

Gerrard St., Morley Ave. to 105 ft. E. of Redwood Ave.

Fir Ave., from Balsam Ave. to Beech Ave. Sparkhall Ave. from Logan Ave. to 646 ft. W.

PUMPING STATION

Pumping Station from Central Low Level Area.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a Guarantee Company approved of as aforesaid.

The usual conditions relating to tendering as prescribed by city by-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,

Chairman, Board of Control.
Toronto, January 22nd, 1914.

4

Wanted Employees

WANTED—First-class Architectural Draughtsman. Permanent situation if satisfactory. State terms and experience. Box 937 Contract Record, Toronto.

4-5



Sealed tenders addressed to the undersigned, and endorsed "Tender for Pile Wharf and Approaches at Gananoque, Ont.," will be received at this office until 4 p.m., on Monday, February 23, 1914, for the construction of a Pile Wharf and Approaches at the Town of Gananoque, County of Leeds, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the District Engineer's Office, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Gananoque, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS.

Secretary.

Department of Public Works,
Ottawa, January 23, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—50087. 4-5

(Continued from page 35)

Edward St., for the steel framework of the Broadway and Victoria Drive viaducts. The work will be started at once.

Public Buildings, Churches, Schools, etc.

Acton, Ont.

Tenders addressed to Sec., R. C. Desrochers, Pub. Works Dept., Ottawa, will be received until Feb. 4, for interior fittings at the post office. Plans may be seen at Dept., Station "F," Yonge St., Toronto, and W. Holmes, Acton.

Amherst, N.S.

The Schools Commission has under consideration the erection of a high school building. Chairman, B. J. Lawson.

Calgary, Alta.

The Public School Board has purchased a site at Sunnyside for the erection of a school building but nothing further will be done until spring. Bldg. Supt., H. McClelland, City Hall.

Dundas, Ont.

Board of Education has decided to build a new High School at an estimated cost of \$30,000. Chairman, C. E. Dickson.

Edmonton, Alta.

The McDougall Methodist Church Congregation has under consideration the erection of a club building on First St., the accommodation will include 100 rooms, baths, gymnasium, billiard room, and an auditorium for concerts.

Elmira, Ont.

The St. James Lutheran Congregation, Pastor, Rev. Mr. Stumpf, have decided to erect a new church on Arthur St. at an

estimated cost of \$20,000. The architect has not yet been appointed.

Hamilton, Ont.

Ald. Davey is advocating the establishment of a municipal ice plant, at an estimated cost of \$20,000.

Hamilton, Ont.

Fire Chief TenEyck has recommended to the Fire Committee that new stations be erected in the south-eastern and south-western parts of the city, and that the following apparatus be purchased: Motor traction, fire engine, new fire alarm system, new ladders, etc. Truck for Balmoral Ave. Station, and new automobiles.

St. Andrews Presbyterian Church, Pastor, Rev. J. A. Wilson, have under consideration either the enlargement of the present Sunday school building or the erection of a new building.

Lacolle, Que.

The Dom. Realty Co., 34 King St. W., Toronto, Ont., has under consideration the erection, for occupation by the Canadian Bank of Commerce, of a stone and brick building. The cost is estimated at \$15,000 and the work will start in the spring.

London, Ont.

W. Mason, architect, has plans in progress for the erection for F. L. Willgoose, 354 Dundas St., of 2-sty. stores of white brick construction, at an estimated cost of \$12,000.

R. Hueston & Son have under consideration extensive additions to their livery stables on Richmond Street.

Listowel, Ont.

The town council has secured a new site for the erection of the proposed town hall, and the matter will be discussed by them shortly.

Montreal, Que.

The House of Browne Ltd., architects, St. James St., Montreal, will submit sketches to the Board of the Parish of St. Thomas Aquinas, St. Antoine, for a new church on St. Henry St., to be erected at an estimated cost of \$100,000.

A site for the erection of a new church has been purchased on Dorchester St. W. for St. George's Parish. The architect will be chosen shortly. Rev. Patterson Smyth, Dom. Sq.

Montreal, Que., Lachine

Tenders addressed to Sec., R. C. Desrochers, Public Work, will be received until Feb. 9, for interior fittings for post office. Specifications at office of R. L. Deschamps, Overseer Public Bldgs., Post Office, Montreal; Dalbe Viau, 29 16th Ave., Lachine, and at Dept., Ottawa.

Ottawa, Ont.

Mr. John Henderson, Clerk to the Board of Control, has been instructed to get in touch with abattoir designers and builders and obtain information regarding working and cost.

Tenders will be received by City Engineer, Arch. Currie, for alterations to the entrance of the City Hall.

Plans are in progress for alterations to entrance to the City Hall, including the installing of revolving doors. Tenders will be called shortly.

The work on main buildings of the barns and stables at the Experimental Farm planned by the Public Works De-

partment, has been postponed until the spring.

First Congregational Church are considering the erection of new Sunday School premises. Secretary, J. S. Chamberlain.

River Glade, N.B.

F. N. Brodie, architect, 42 Princess St., St. John, N.B., will receive tenders in about ten days for the remodelling of the Jordon Memorial Sanitarium.

Stratford, Ont.

The Country Club proposes to build a new club building. Probable architect, R. Thos. Orr, 21 Downie Street.

St. Agathe, Que.

Finley & Gagnon, architects, New Birks Bldg., Montreal, expect to call tenders on behalf of the Public Works Dept. for post office building within the next 10 days.

Stamford Twp., Ont.

The township council is considering the erection of a 4-room school on Lundy's Lane. Clerk, C. F. Munroe, South-end.

Toronto, Ont., Richmond Hill

Plans for the erection of a school building may be seen at office of Sec. Bldg. Com., H. A. Nicholls, who will receive tenders on and after Feb. 2nd until the 16th for all trades. Brick, sand, gravel and water will be supplied by the Board.

Toronto, Ont.

The footings of the Parkdale Canoe Club House at Sunnyside are being erected by Harbour Commission, and plans for the building are being prepared by Geo. N. Molesworth, architect, 2 College St., who will call tenders next month.

The Runnymede Presbyterian Church Congregation are considering the erection of a new church with a seating capacity of 500. Pastor, Rev. B. B. Weatherall, 132 St. Johns Road.

The Board of Education has been advised by Inspector Armstrong to enlarge the grounds of Park School and construct a modern building. Sec., W. C. Wilkinson.

It is proposed to make certain additions to King George and George Syme schools at an estimated cost of \$10,000. Clerk to School Section No. 29, W. A. Clarke, 40 Jarvis street.

The Board of Education has received a report from Inspector Armstrong advising the construction of a new Jesse Ketchum School building.

Toronto, Ont., Eglinton

An addition to the present Presbyterian Church building is under discussion; it is possible however that a new church may be erected. Pastor, Rev. W. G. Back, 49 Glencairn Ave.

Toronto, Ont., Mimico

Mimico Presbyterian Church Congregation have decided to refurnish the Sunday School building.

North Vancouver, B.C.

Mr. J. Findlay, Chief of the Fire Dept., has recommended to the municipal council the purchase of a site for a sub-fire hall.

Victoria, B.C.

Work on the new church for the First Baptist Church Congregation has been postponed until the matter of finances has been satisfactorily arranged.

School Board has applied for the sum

of \$21,000 for the purchase of new furniture. Sec., W. T. C. Pope, 1127 Catherine street.

Winnipeg, Man.

It is understood that this year's plans of the Winnipeg Public School Board include the erection of three school buildings and certain additions to six schools.

Woodbridge, Ont.

Woodbridge Agricultural Society has decided to enlarge grounds and erect building for sheep and swine. Sec., V. L. Wallace.

CONTRACTS AWARDED

Peterboro, Ont.

The following contracts have been awarded in connection with the remodeling of the hotel on Charlotte street, for the Chamberlain Estate. Carpentry, Ephgrave & Barret; plastering, Wm. Saxby; painting, Geo. Duncan. The contract for heating, plumbing and electrical fittings is still open, and that for interior fitting is not yet called.

Business Buildings and Industrial Plants

Cardston, Alta.

Royal Bank of Canada has purchased a site on Main St. for the erection of bank premises.

Hamilton, Ont.

The Wilys Overland Co. of Toledo, Ohio, is negotiating for suitable premises here with the object of extending their operations.

The Standard Underground Cable Co. has under consideration extensive improvements and additions to their factory on Sherman Ave. N. The estimated cost is \$150,000.

Montreal, Que.

Tenders have been received for replacing the wall of the MacFarlane Building, St. James and Richmonds Sts., and contracts will be awarded shortly.

Tenders for alterations to the warehouse of Adam Beck & Co., Jurors St., have been received and contracts will be awarded shortly.

Montreal, Notre Dame de Grace, Que.

Jos. Denis, 107 Belgrave St., who has the contract for the erection of 5 stores and 15 flats on Sherbrooke and Harvard Sts., for Belanger and Duguet, is open to receive sub-tenders for plastering, plumbing, heating and electric fixtures. Contracts will be awarded about Feb. 1st.

Niagara Falls, Ont.

A by-law to grant free a site to Dom. Chain Co., Ltd., Ellen Ave., will probably be submitted to ratepayers in February.

Ottawa, Ont.

Plans for stables at the corner of Gladstone and Kent Sts., have been drawn by H. N. Bate, 109 Sparks. The specifications provides for solid brick construction, felt and gravel roofing, electric lighting, hot water or hot air heating, birch, concrete and pine floors, stable fixtures, concrete foundation, waterproofed. Estimated cost \$60,000.

Petrolia, Ont.

The Canadian Oil Refinery have plans in progress for the erection of a 2-sty. stone and concrete foundation, white brick construction, wax factory at an esti-

mated cost of \$20,000. Machinery will also be required.

Regina, Sask.

The Constructors Ltd., 810 Dewdney Ave., has under consideration the erection of a 2-sty. office building at an estimated cost of \$15,000.

Three Rivers, Que.

The Dom. Realty Co., 34 King St. W., Toronto, has under consideration the erection, for occupation by Canadian Bank of Commerce, of a stone and brick building. The cost is estimated at \$20,000, and the work will start in the spring.

Toronto, Ont.

Plans have been drawn by W. S. Thompson, architect, 358 Brunswick Ave. for reconstructing the foundry of Foundry Specialties Co., Cherry St.

Wallace Twp., Ont.

Albert Rolls, Con. 4, Wallace Twp., Listowel P.O., contemplates the erection of stone and concrete foundation farm buildings.

Kerr Bros., 486 Queen St. W., are considering the erection of a brick and mill construction factory.

Plans have been drawn for an up-to-date laundry building on Pape for Lee Peters, 558 Yonge St.

Winnipeg, Man.

Plans have been drawn for E. Deelogis, 586 Alexander Ave., by C. W. Sharpe & Son, architects, 231 Gorry St., for the erection of a store and residence at the corner of Logan and Beacon streets.

CONTRACTS AWARDED

Montreal, Que.

Sub-contracts for the alterations to Royal Trust Co. Building, at corner of Fortification and St. George Sts. General contractor, Jas. Shearer, have been let to elevator, Otis Fensom Elev. Co.; sprinkler system, Rockwood Sprinkler Co. of Canada, Ltd.

St. John, N.B.

E. G. M. Cape, New Birks Bldg., Montreal, who has the contract for the Atlantic Sugar Refinery Co.'s new premises has let the contract for terrazzo flooring to Smith Marble Co., 145 Van Horne Ave., Montreal.

Residences

Brockville, Ont.

Tenders for alterations to apartments addressed to A. Stuart Allaster, architect, received on behalf of Mrs. W. J. McHenry, until Jan. 26. Estimated cost \$6,000.

Chippawa, Ont.

C. M. Borter, architect, Niagara Falls S., has plans in progress for 16-room residence and barn for W. L. Doran, Niagara Falls.

Guelph, Ont.

W. A. Mahoney, architect, has plans in progress for the erection of a residence for W. A. Russell, Wellington Place.

Hamilton, Ont.

Plans have been drawn by Mackay Bros., Lister Chmbrs., James St., for the erection of 18 residences at an estimated cost of \$3,000 each. They are also considering the erection of 35 additional residences.

London, Ont.

Sketches have been drawn for R. A.

Y. Stinchcombe, Wharnccliffe Rd., by architect A. E. Nutter, for an apartment house at an estimated cost of \$25,000.

The McClary Mfg. Co. have under consideration the building of a number of houses for their workers.

Montreal, Que.

A permit has been issued to Henri Hogue for six flats, \$7,000, Park Ave.

A permit has been issued to Leduc & Charette for three flats, \$6,000.

A permit has been issued to Mrs. Caroline Drapeau for six flats, \$6,000.

E. Payette, architect, 103 St. Francois Xavier St., has plans in progress for the erection of 2 residences on Parc Lafontaine, for O. Archambault. Estimated cost \$20,000.

Montreal, Que., Cote des Neiges

Tenders for alterations were received by C. B. Gordon, Cote des Neiges and Queen Marys Rd., but were not accepted. It is understood that contractors are re-considering their estimates.

Regina, Sask.

Parsons Constr. Co., Ltd., Scarth St., has under consideration the erection of a 3-storey, reinforced concrete, fireproof and brick construction, apartment block. Estimated cost \$45,000.

Sarnia, Ont.

The town council is interested in a by-law which will shortly be submitted to the ratepayers to guarantee the bonds of a company to be formed for the purpose of erecting houses. Mayor, J. B. Dagan.

Toronto, Ont.

Tenders will be received by S. B. Coon & Son, architects, emple Bldg., on behalf of C. W. Defoe, 47 Simcoe street, until Feb 10th, for the erection of a duplex residence on Glen road.

Sketches have been drawn and the Board of Control has approved of the site on Carlton for the erection of a large rooming house for W. E. Dyer, 160 Huron street, the estimated cost is \$125,000.

Plans drawn for the erection of a pair of residences on Mountnoel Ave., have been drawn for D. A. Blais, 948 Logan Ave.

Plans have been drawn for 2 pair residences for Ed. Elliott, 77 Vermont St., who will sublet to some trades. estimated cost \$9,000.

Victoria, B.C.

The work on the large apartment block at the corner of Blanchard and Quadra streets, for C. C. Pemberton & Syndicate, has been postponed until financial situation becomes brighter.

Miscellaneous

Calgary, Alta.

Tenders addressed to Sec., R. C. Desrochers, Public Works Dept., Ottawa, will be received until Feb. 11th, for one Standard freight passenger elevator and 3 standard freight elevators, complete with motor generator sets, to be installed at the examining warehouse. Plans at office of Leo. Dowler, Res. Architect, Calgary, H. E. Matthews, Res. Architect, Winnipeg, Man., and at Dept., Ottawa.

Edmonton, Alta.

Edmonton Leather & Shoe Co., Ltd.

(Continued on page 40)

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are increasing their operations and will purchase additional machinery for their factory.

Hamilton, Ont.

The Board of Control has under consideration the purchase of a stone quarry and industrial farm, to be worked by prison labor.

The city council is having estimates prepared and tenders will be called for lumber, paving brick, asphalt, cement, sewer and water pipe, hydrants, waterworks fittings, etc.

London, Ont.

Tenders will be called immediately by the city council for the supply of 1,000 ft. 2½-in. rubber lined fire hose. Fire Chief, J. Aitken, Central Fire Hall.

Montreal, Que.

Tenders addressed to L. N. Senecal, Sec. to the Board of Commrs., will be received until noon Feb. 19, for the supply and delivery of about 6,750 tons cast iron pipes. Specifications can be seen at office of Purchasing and Sales Agent, City Hall.

Ottawa, Ont.

The Eastview Council are about to purchase fire apparatus to the value of \$5,000.

Tenders will be called in about three weeks by the city council for the supply of cement for 1914.

The city council will shortly call tenders for the supply of vitrified clay pipe for 1914.

Tenders for the supply of brick and stone setts for 1914 will be called by city council in about 3 weeks time.

Specifications are being prepared for the supply of stone for 1914. Tenders will be called by the city council shortly. City Engineer, Arch. Currie.

Sarnia, Ont.

The Fire Committee has decided to purchase 1000 ft. fire hose, and will also call tenders for a new concrete floor in the fire hall. Chairman of Com., Dr. Henderson.

Toronto, Ont.

The Property Com. has approved of the estimate of \$4,500 for providing an extra elevator at James St. entrance of City Hall.

Denison & Stephenson (in Trust), 20 King St. W., are calling for tenders for the removal of building on north-east corner of Temperance and Shepherd Sts.

Business Notes

Kingston, Ont.

The Anglo American Hotel, Ontario St., has been damaged by fire to the extent of \$5,000.

Lewiston, N.S.

The peg factory of J. Lewis & Sons including machinery has been destroyed by fire; estimated loss \$50,000.

Mountain Grove, Ont.

The C. P. R. station building and freight shed have been completely destroyed by fire.

Montreal, Que.

The shoe store of H. Waggner, 2373 Notre Dame W., was recently destroyed by fire. Estimated loss \$5,000.

Paris, Ont.

The stables and garage owned by Dr. W. Faskin and Dr. Dunton have been

destroyed by fire. The estimated loss is \$6,000.

Toronto, Ont.

The warehouse building on Terauley St., owned by Richard Russell, 353 Markham St., has been destroyed by fire, and the following firms suffered losses as specified. Automatic Electric Cooking Co., \$15,000; J. W. Hewetson Mfg. Co., (shoe manufacturers), \$10,000; Pratt Food Co., \$5,000; Can. Seamless Wire Co. and Can. Smelting & Refining Co., \$10,000. Losses were all covered by insurance.

New Companies

The Iberville Granite Works, Ltd., has been incorporated with a capital of \$20,000, with head office at Iberville, Que. The provisional directors are G. E. Tremblay, sculptor, Iberville, Que., and R. Archambault, merchant, of Montreal.

Chateauvert Quarry Co., Ltd., has been incorporated with a capital of \$75,000, with head office at Quebec. The provisional directors are N. Drouin, E. Drouin, and A. Drouin, merchants, E. B. Ratray, manager, and F. O. Dufour, all of Quebec.

Sedgewick Land and Investment Co., Ltd., has been incorporated with a capital of \$99,000, with head office at Montreal, to carry on business as a general land and building company. The provisional directors are J. E. Desy, agent, F. A. Herbert, broker, J. A. Gagnon, broker, W. Pepin, agent, and H. S. M. Caron, advocate, all of Montreal.

Canachan North-West Development Co., Ltd., has been incorporated with a capital of \$200,000, with head office at Montreal. The provisional directors are J. T. Hackett and H. R. Mulvena, advocates, of Montreal.

Viger-Foster Valve Co., Ltd., has been incorporated with a capital of \$250,000, with head office at Montreal, to carry on business as mechanical engineers. The provisional directors are E. R. Perkins, advocate, and W. Taylor, accountant, of Montreal.

Burke-Aylett, Ltd., has been incorporated with a capital of \$25,000, with head office at Winnipeg, to carry on business as a general land and building company. The provisional directors are G. Coulter, A. B. McAllister, and J. F. McCallum, barristers, of Winnipeg.

John L. Watson Land Co., Ltd., has been incorporated with a capital of \$500,000, with head office at Winnipeg, to carry on business as a general land and building company. The provisional directors are J. L. Watson, R. S. Beattie, J. Kay, real estate agents, and A. E. Bowles, barrister, all of Winnipeg.

The Saint John Sand and Gravel Co., Ltd., have been incorporated with a capital of \$24,000, with head office at St. John, N.B. The provisional directors are F. R. Fairweather, insurance agent, A. J. Wheaton, manager, J. C. Chesley, clerk, R. M. Rive and H. A. Porter, barristers, all of St. John, N.B.

Tinney and Humphries, Limited, has been incorporated with a capital of \$50,000, with head office at Vancouver, B.C. to carry on business as general contractors and engineers.

J. Fyfe Smith Co., Ltd., has been incorporated with a capital of \$200,000, with

head office at Vancouver, B.C., to carry on business as lumber merchants.

MacConnell Lumber Co., Ltd., has been incorporated with a capital of \$50,000, with head office at Vancouver, B.C., to carry on business as lumber merchants.

Baker & Pringle, Ltd., has been incorporated with a capital of \$20,000, with head office at Collingwood, East, B.C., to carry on business as lumber merchants.

Stamp Falls Power Co., Ltd., has been incorporated with a capital of \$150,000, with head office at Victoria, B.C., to carry on business as a power company.

Bain and Wilson, Ltd., has been incorporated with a capital of \$10,000, with head office at South Fort George, B.C., to carry on business as general contractors.

Superior Sash and Door Co., Ltd., has been incorporated with a capital of \$60,000, with head office at Vancouver, B.C. to acquire and carry on the business of John Edward Dougherty, New Westminster, B.C., and to carry on business as timber merchants.

Cotton Co., Ltd., has been incorporated with a capital of \$50,000, with head office at Vancouver, to carry on business as general contractors.

Taylor Portable Steel Derrick, Ltd., has been incorporated with a capital of \$40,000, with head office at Toronto. The provisional directors are G. M. Kelley and J. D. Falconbridge, barristers, of Toronto.

Chapmans, Ltd., has been incorporated with a capital of \$300,000, with head office at Toronto, to carry on business as general contractors. The provisional directors are N. Sommerville, J. E. Jones, H. A. Newman and T. A. Rowan, barristers, all of Toronto.

The Equity Builders and Contractors, Ltd., has been incorporated with a capital of \$40,000, with head office at Toronto, to carry on business as general contractors. The provisional directors are H. A. Newman, barrister; V. H. Hatten and J. W. Murphy, all of Toronto.

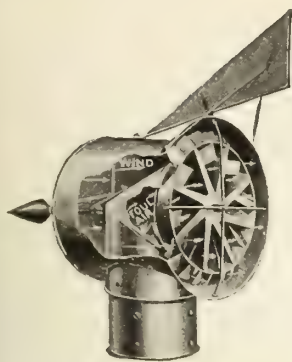
Shannon Realities, Limited, Montreal, incorporated, capital \$150,000. Incorporators, W. R. L. Shanks, E. S. McDougall and D. P. Gillmor, advocates, all of Montreal.

National Silica Sands, Limited, Montreal, incorporated, capital \$150,000. Incorporators, E. R. Parkins, advocate, A. C. Calder, manager, and W. Taylor, accountant, all of Montreal.

Building Products, Limited, Toronto, incorporated, capital \$200,000. Incorporators, W. Douglas and R. J. Gibson, barristers, and Bosville Place, gentleman, all of Toronto.

The Fraser-Brook Lumber Co., Ltd., Fraserville, Que., incorporated, capital \$99,000. Incorporators J. Langlais, advocate; J. E. Pineau, Noel Fortin and A. Lemieux, merchants, all of Fraserville, Que.; B. Frechette, timber merchant, St. Honore, Que., and J. H. Rousseau, notary, Trois-Pistoles, Que.

Canadian Hotpoint Electric Heating Co., Ltd., Toronto, incorporated, capital \$100,000. Incorporators, E. H. Richardson and P. H. Booth, Ontario, Cal., U.S.A., manufacturers; J. R. Richardson, Chicago, Ill., U.S.A., manufacturer; W. L. Rowley and B. E. Rowley, Toronto, Ont., manufacturers.



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Newport Const. Co., Newport, N.Y.
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Barber Asphalt Company, Buffalo, N.Y.
Jos. F. Stabell Company, Buffalo, N.Y.
Thos. Brown Construction Co., Buffalo, N.Y.
A. J. Rockwood, Rochester, N.Y.
F. C. Humeston, Brooklyn, N.Y.
H. P. Burgard, Buffalo, N.Y.
Eastern Concrete Steel Company, Buffalo, N.Y.
W. J. Burns Company, Rochester, N.Y.
Whitmore, Rauber & Vicinus, Rochester, N.Y.
James Garafano & Sons, Mt. Vernon, N.Y.
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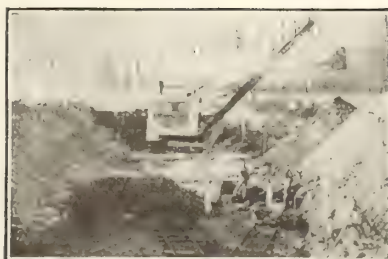
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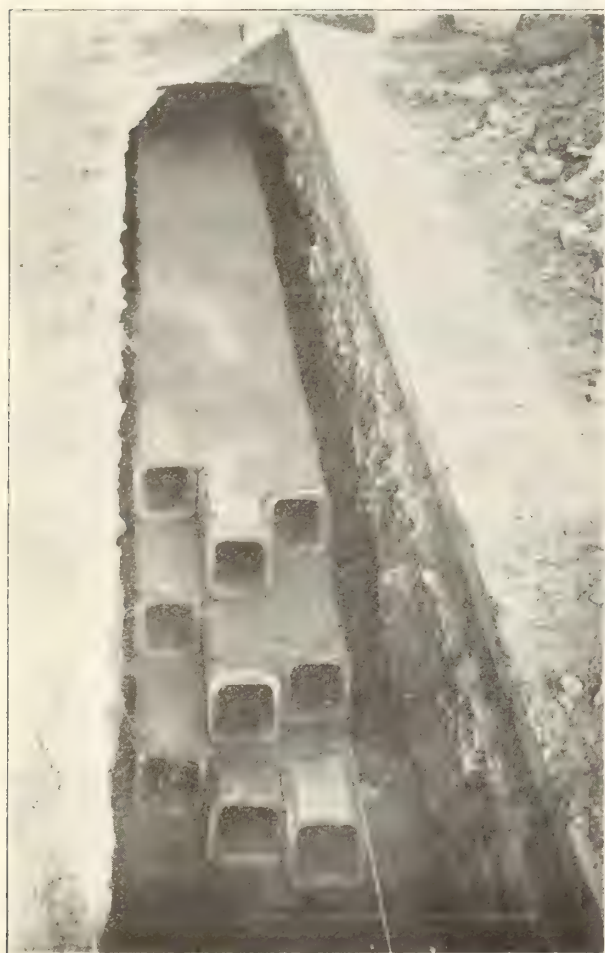
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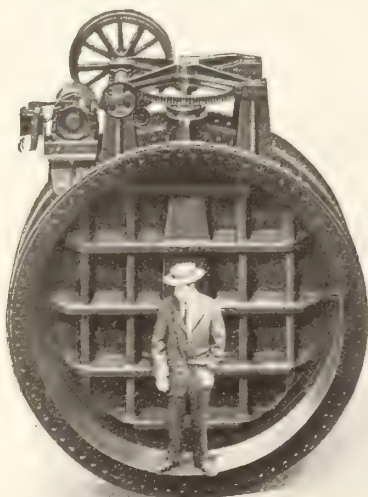
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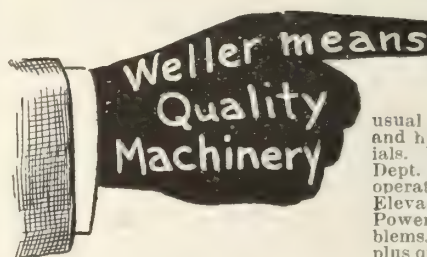
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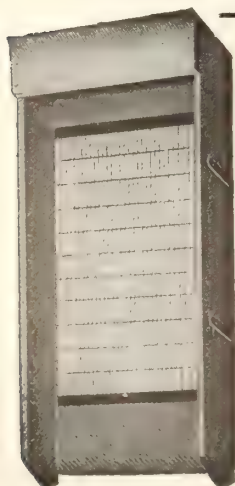
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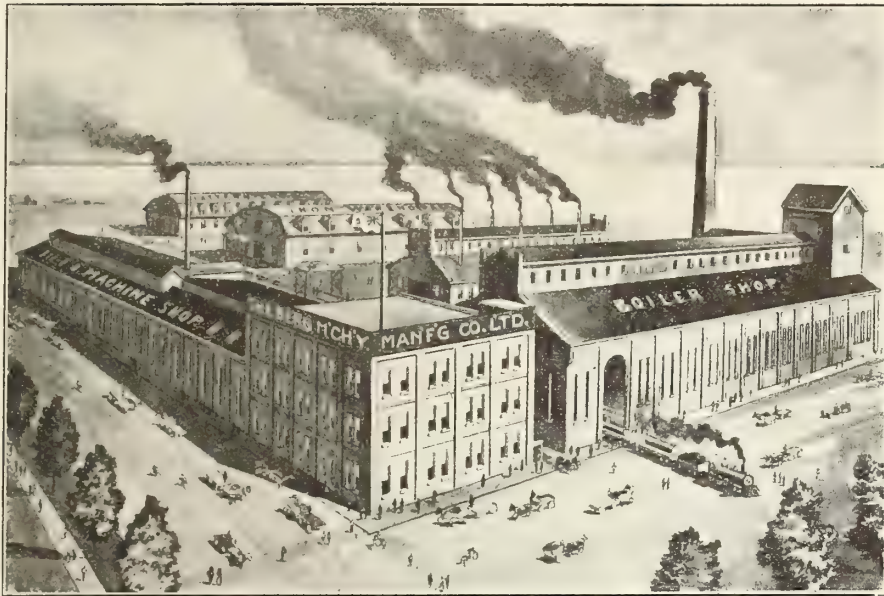
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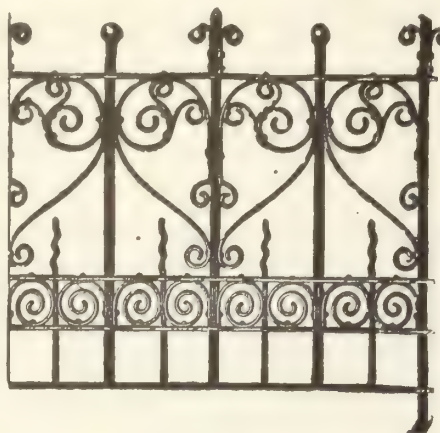
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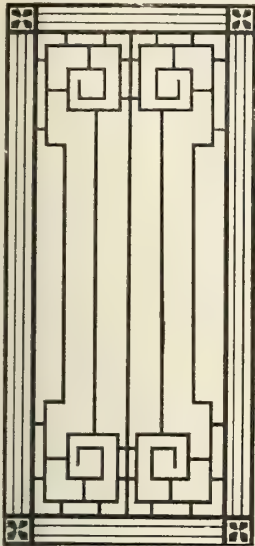


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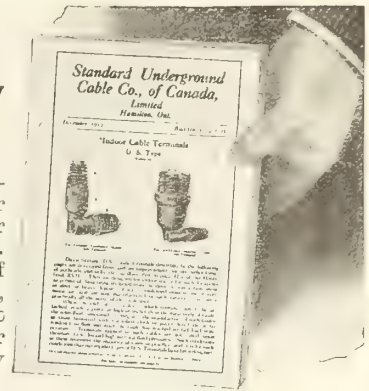


Table of Contents

General Description of D. S. Terminals.
Regular Types of D. S. Terminals.
Inner Seal Terminals.
Wiped Joints vs. Clamped Joints.
Separation and Insulation of Conductors.
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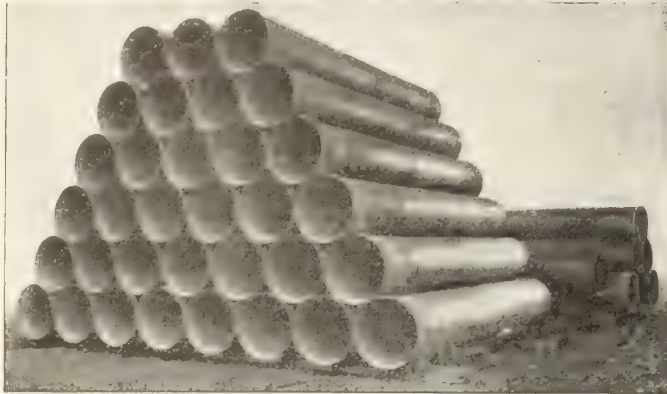
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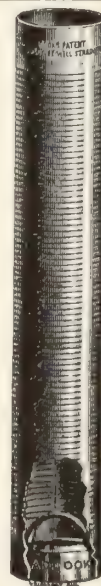
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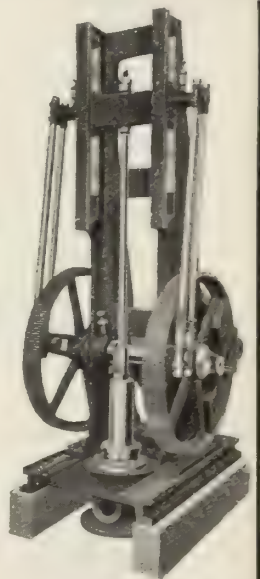
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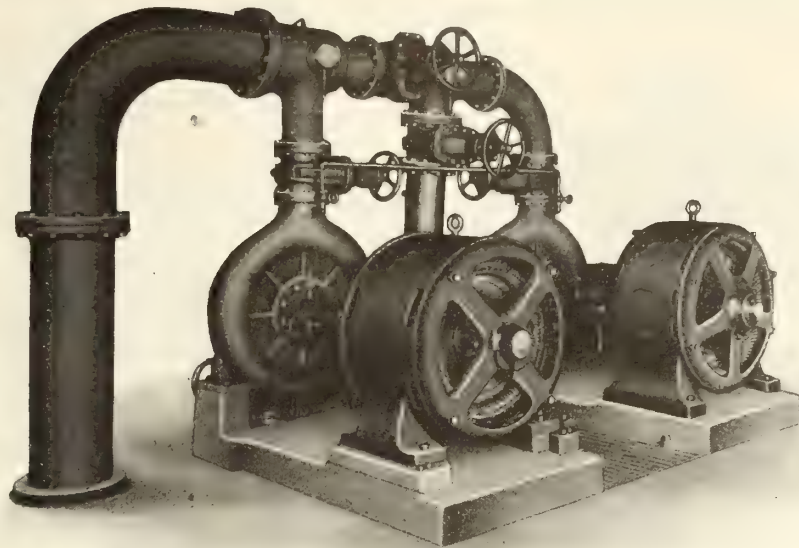
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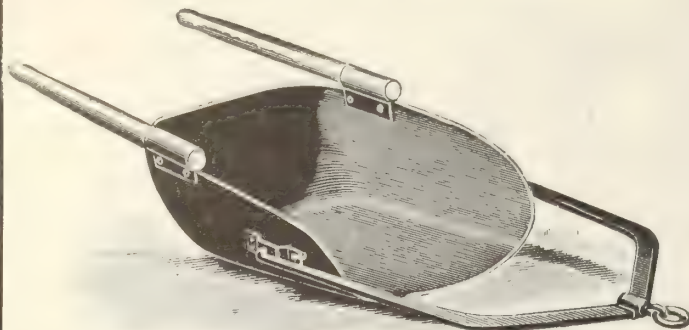


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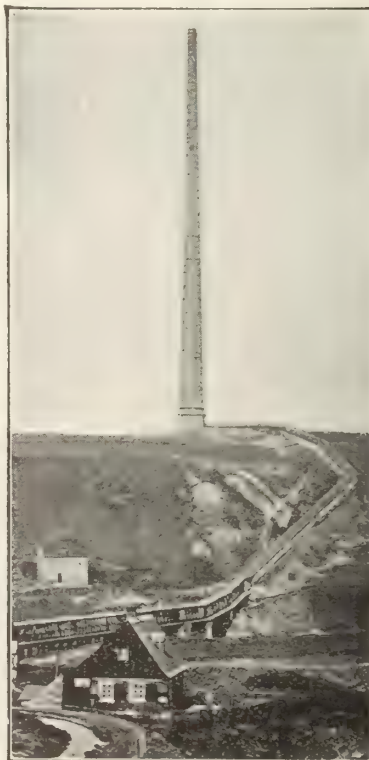
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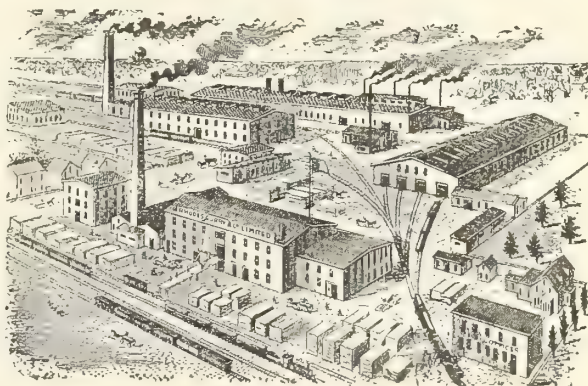
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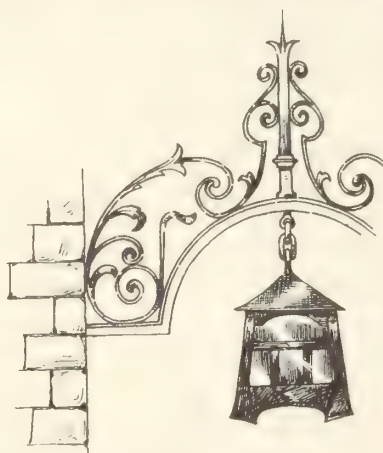
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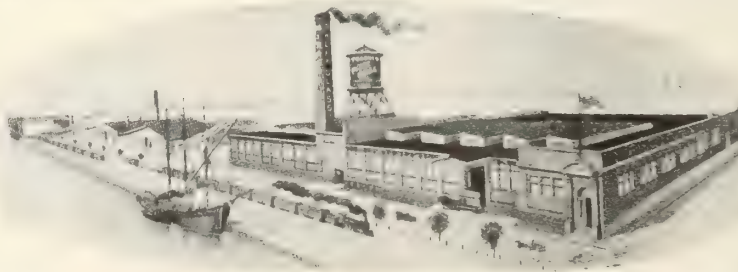
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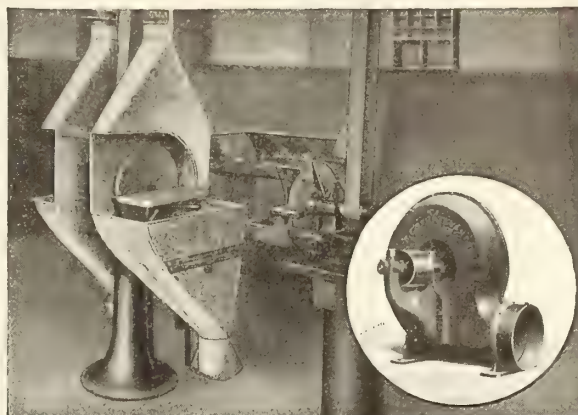
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SALES OFFICE FOR EASTERN CANADA
919 New Birks Building, Montreal

Current Prices of Building and Engineering Materials

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	\$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Brick	13 00
Grey Stock Brick	12 00
Wire cut brick for foundation work	11 00
Porous terra cotta brick	15 00
No. 1 enamelled brick, all colors, from	\$80 00 to \$150 00
Sand-Lime Brick (King Edward Siding)	8 10

LUMBER (Building Material)

Hemlock Lumber—	
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	\$26 00
2 x 4 to 2 x 12, 16 ft.	26 00
2 x 4 to 2 x 12, 18 ft.	29 00
1 in. Hemlock, No. 1	25 00
No. 1 Hemlock Decking	25 00
No. 2 Hemlock dimension and 1-in.	19 00
Pine—	
1 in. common pine 8 to 12 in. wide rough	26 00
2 in. white pine Bill stock	29 00
2 x 8 and 10 in. pine shelving	36 00
2 x 12 in. pine shelving	45 00
No. 1 white pine flooring	33 00
No. 1 spruce flooring	28 00
No. 1 pine decking D2S	30 00
Spruce Decking	28 00
No. 1 pine V. or headed sheeting	36 00
No. 2 pine V. or headed sheeting	32 00
Pine trim for paint finish—	
4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8 in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75
Shingles—	
XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00
Cedar Posts—Fence—	
5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50
Dimension Timber up to 32 feet:	
8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x18, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$6 25
26 to 40	4 60	6 75
41 to 50	5 10	7 50
51 to 60	5 35	8 50
61 to 70	5 75	9 75
71 to 80	6 25	11 00
81 to 85	7 00	12 50
86 to 90		15 00
91 to 95		17 50
96 to 100		20 50
101 to 105		24 00
106 to 110		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	\$3 25	\$4 75
40	3 45	5 20
50	3 55	6 00
60	4 10	6 50
70	4 35	7 00
80	4 55	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	\$3 50	\$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 65 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 70 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net\$1.85
No. 4½ Fuller's net\$2.35
Square head brass cocks, 65 and 5 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6¼ cents per lb.; traps and bends, 40 per cent.; pig lead, 6¼ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black	Galvanized
¼ inch	\$2.16	¾ inch \$3.06
½ "	2.16	1 " 3.06
¾ "	2.64	1½ " 3.57
1 "	3.05	2 " 4.20
1½ "	4.51	2½ " 6.21

1¼ "	6.10	1¼ "	8.40
1½ "	7.29	1½ "	10.04
2 "	9.81	2 "	13.51
2½ "	16.80	2½ "	21.65
3 "	20.66	3 "	28.31

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 and 10 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.
Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.
Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; ¾-inch, \$1.45.
Burnt River rubble stone delivered, \$16 to \$17 per ton.
Plain steel bars, \$2.25.
Square twisted bars, ¾ to 1½, \$2.35.
Malleable fittings — Canadian discount, 45 and 42½ per cent.
Free stone delivered, \$15 to \$18 per ton.
Brown coursing stone, delivered, \$3.75 per yard.
Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.
Sand, for cement or brick work, \$1.20 a cubic yard, f.o.b. Toronto, C. P. R. siding.
Sand, for cement or brick work, 85c to \$1.00 a cubic yard, f.o.b. Toronto, G. T. R. sidings.
Brown sills and heads, in the rough, delivered, 40 cents per foot.
Rubble stone in car lots, \$1.30 per ton.
Steel channels and beams, angles and plates, \$2.55 to \$2.90 per 100 pounds, delivered f.o.b. Toronto.
Hard Wall Plaster, unsanded, from \$8.00 to \$8.50. bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.
Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.
Plaster of Paris, Anchor and Crown Brands, \$1.50 bbl.
Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, \$8.75 per 100 lbs.
Boiled Linseed Oil in bbls., 65c per gal. of 9 lbs.
Raw Linseed Oil, in bbls., 62c per gallon.
Pure Red Lead, dry, \$7.00 to \$8.00 per 100 lbs.
Putty, pure linseed oil, in bulk, bbls., 3¼c.
Putty, pure linseed oil, in 25-lb. tins, 4c.
Turpentine in bbls., 66c.

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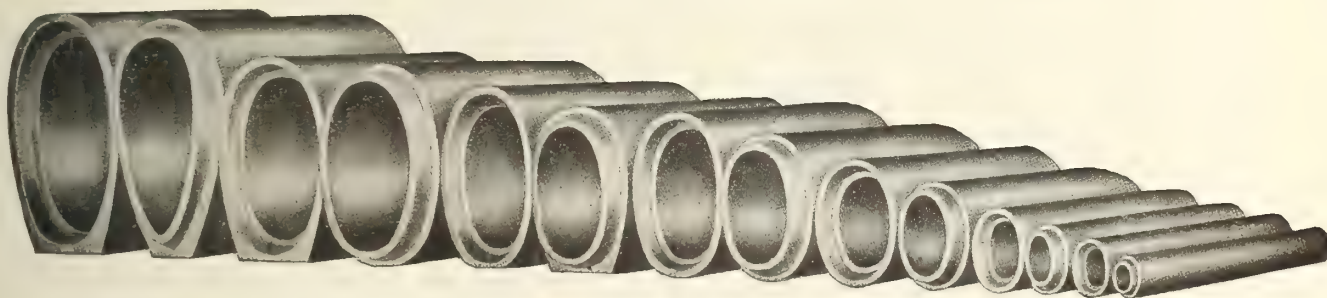
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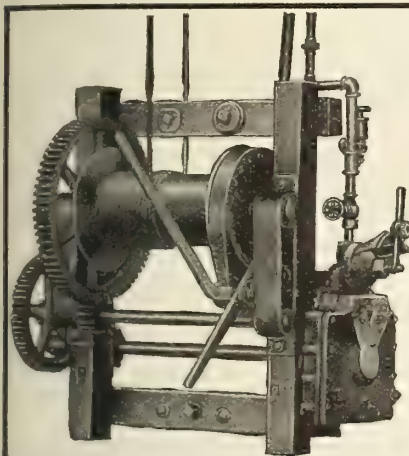
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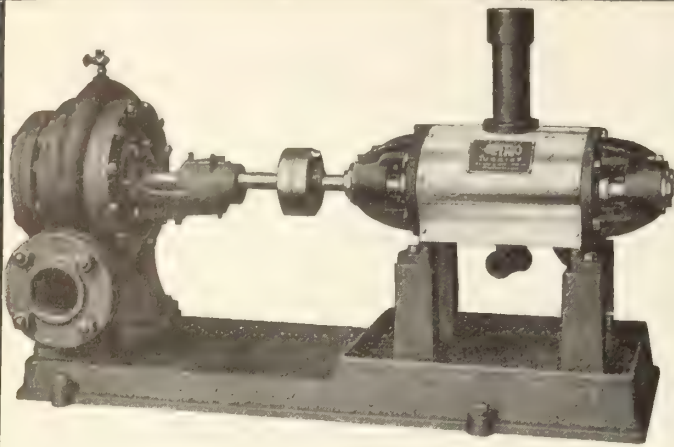
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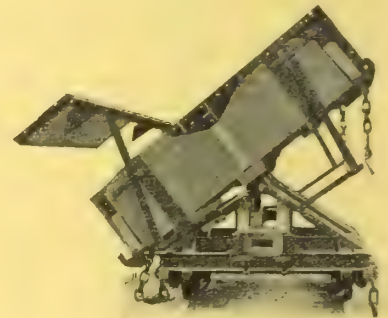
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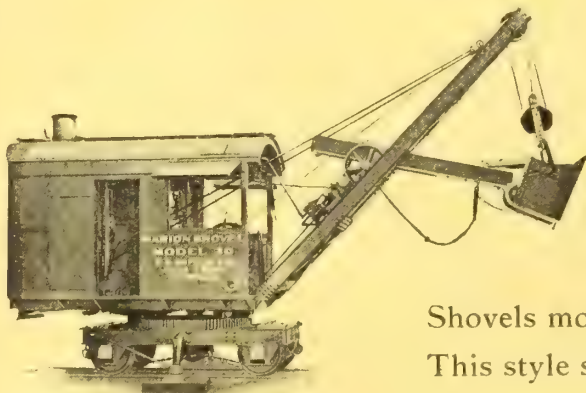
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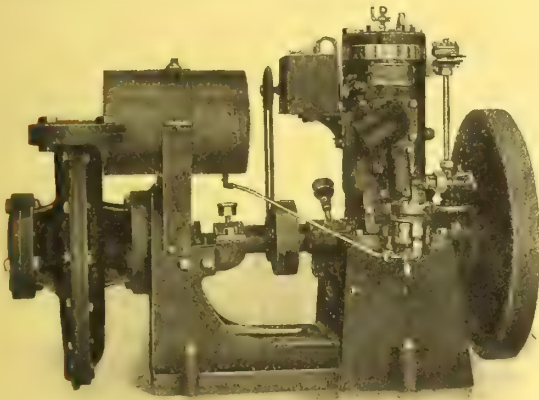
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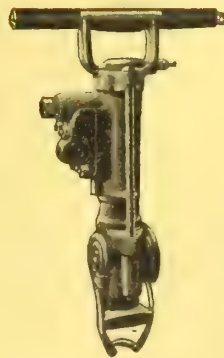
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"American" Double Cylinder Erectors' Engine

has every qualification of strength, speed and ease of operation. The drum and winch head shafts are half an inch larger than those used on standard engines. The winch head clutches are cast steel; **they will not break.**

The winch heads are loose on the shafts and are thrown into use by hand levers and clutches. Each winch head has a ratchet and pawl and is individually operated. This permits part of the lines being made fast while the rest are in use; **a most important feature.**

Extra large boiler. You know what that means to pile driving and fast work.

Drum diameter can be quickly enlarged for speedy work, with Standard "AMERICAN" Wood Lagging.

This engine has been carefully designed to meet every requirement of bridge and building work. It stands high among erectors and it does so because it always gives the fullest measure of service.

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American Hoist & Derrick Company

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Concrete Withstands The Severest Tests—



In the San Francisco earthquake and the Ohio floods, concrete structures withstood the terrific tests of fire, water and vibration without damage.

Now, right in our very midst, comes a striking illustration of concrete's enormous power of resistance and durability.

This great concrete structure, built only to resist the pressure of grain from the inside, while filled almost to capacity with 55,000,000 pounds, or 27,500 tons of grain, settled to an angle of 30 degrees from its original perpendicular position.

In the settling, the walls were subjected not only to the terrific twisting strain of their own weight, but to the weight of thousands of tons of grain as well.

Contract for the restoration of this enormous structure has been awarded to Barnett & McQueen, and it is anticipated that it will be put back into its original position without the slightest injury.

No Loss of Contents

Think of the irreparable loss, had this elevator been built of some destructible material—a material that would have collapsed almost as soon as the settling commenced, and which would have entailed not only the loss of the building, but almost a total loss of its contents.

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is evident only when the character
of its work is known.

It is the Greatest Recrusher on the Market

For material that is not over eight inches in diameter, we claim there is not another crusher made that can equal it for capacity, strength or durability.

It is the only crusher which will take the rejections, screened or unscreened, from standard gyratory crushers and reduce same rapidly at one operation to $\frac{3}{4}$ inch size and less.

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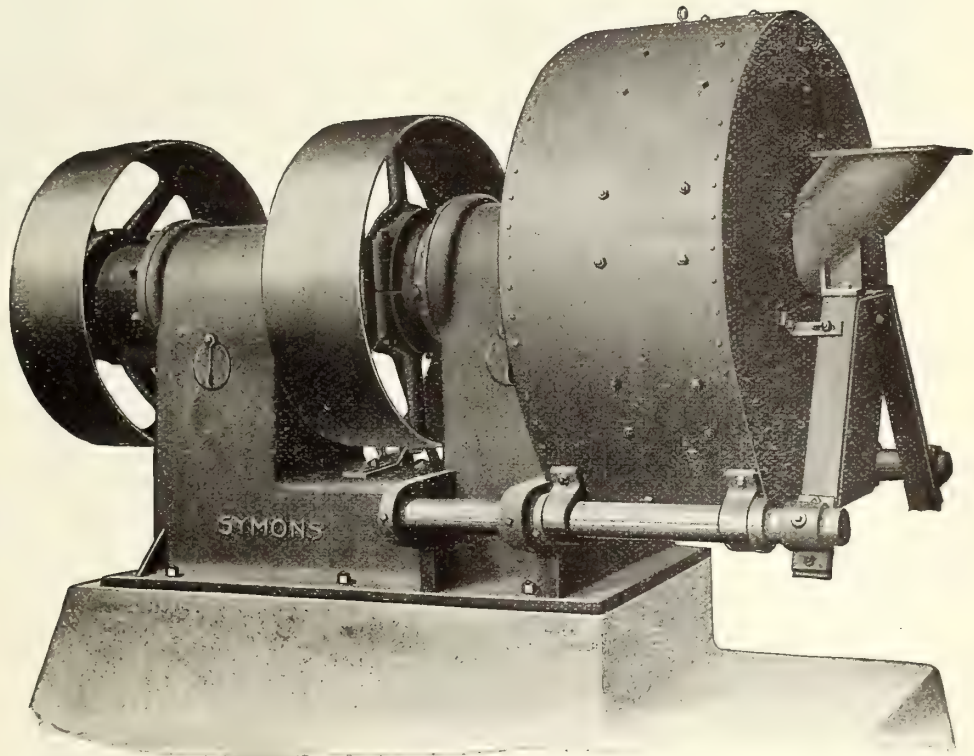
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Special Attention
is given to every working part of the
Symons Disc Crusher
with a view to hard crushing duty and long wear

Crushes 40 tons
of Quarter inch
to
1000 tons of
Two and a Half
inch Stone per
day.



The Manganese Crushing Discs of the Symons wear smooth—not in grooves—allowing them to take up their own wear.

It excels in economy of power, in uniformity of product and in low repair cost.

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Residence of W. W. Butler, Cote St. Antoine Road, Montreal.
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Don Valley Brick

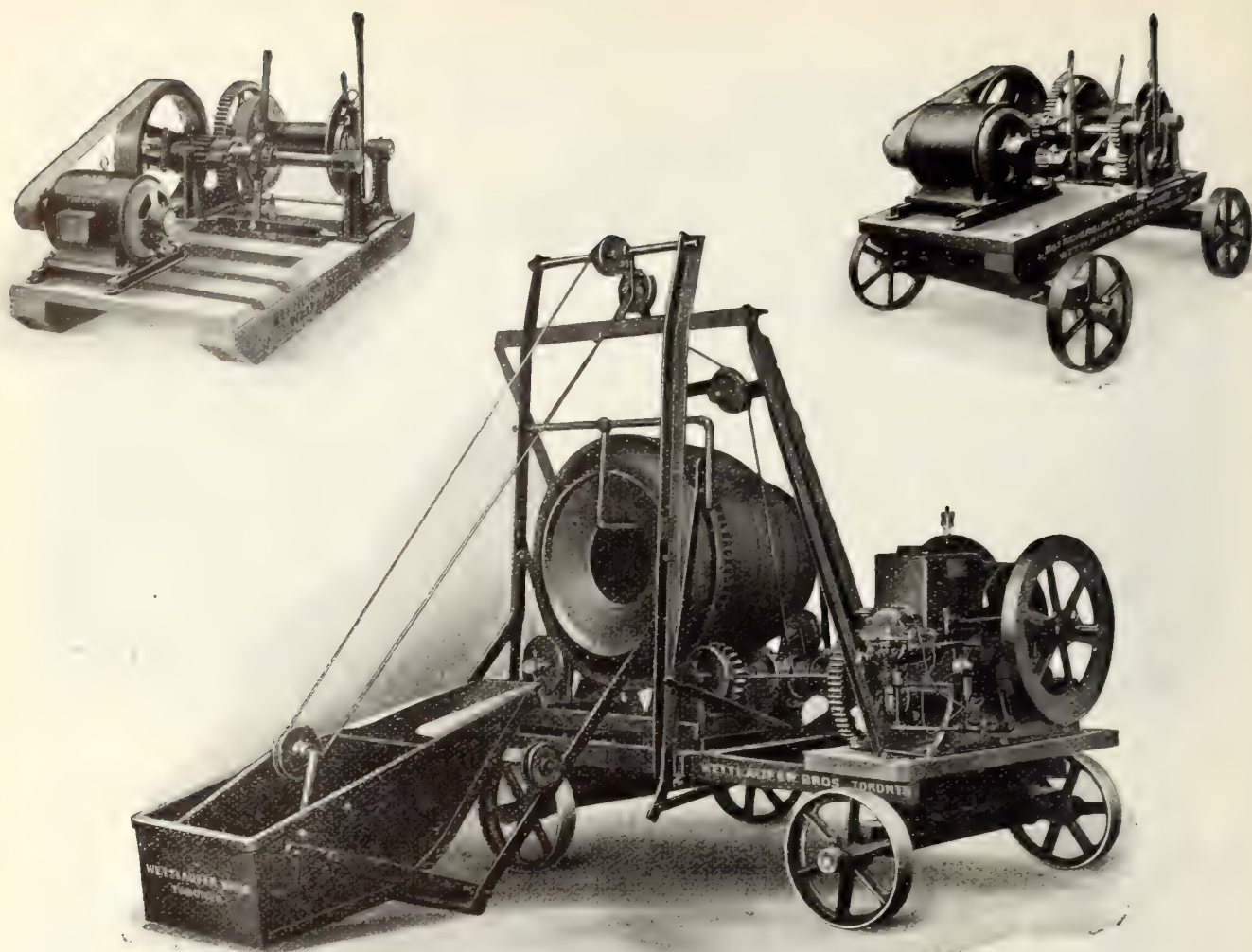
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The illustration shows a handsome Montreal residence in which Don Valley Bricks were used. The resultant rich effect of the brick work thoroughly justified the architect in specifying "Don Valley Bricks."

Don Valley Porous Terra Cotta Fireproofing is used for fireproofing most large buildings.

Don Valley Brick Works

Toronto, Ontario



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Concrete Mixers, Steam and Electric Hoists, Brick Machines, Pumps, Crushers, Stone Screens, Gasoline Engines, Steam Engines and Boilers,

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125' x 5' reinforced concrete chimney. Built for the Dominion Canners Co., Limited, by The Weber Chimney Co., Chicago.

Rogers' Cement used.



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High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

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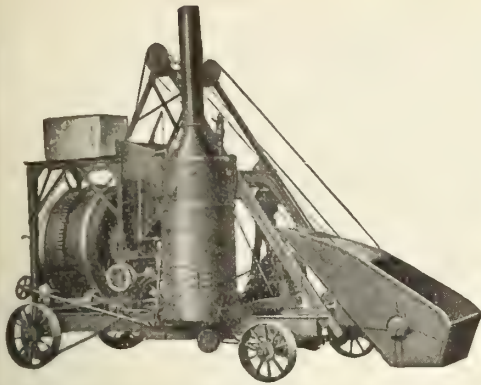


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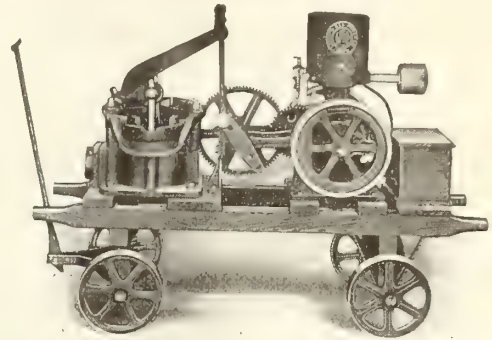
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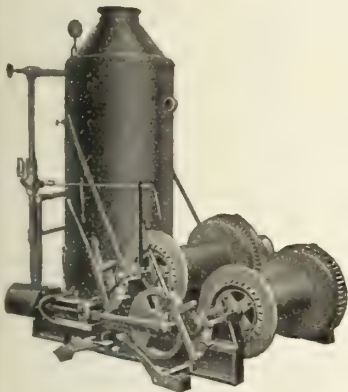
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We Cannot Afford to Make anything but the Best.



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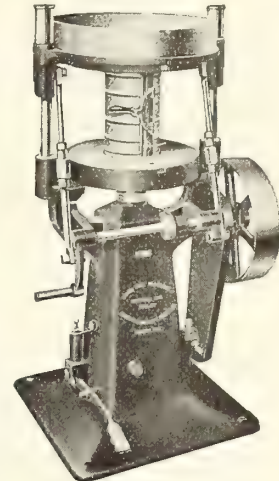
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GENERAL CONTRACTOR
MINING AND HIGH EXCAVATION
CONCRETE WORK & SPECIALTY

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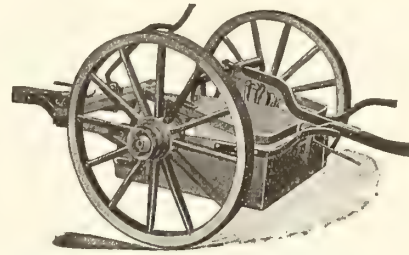
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Windsor Ont.*

Dear Sirs

*I must say that your tools
are all you claim for them these same
with the old style tools could not do as
much work as fine a job as we can with
your tools. I for my sake would not
use any other tools in sidewalk work or
in laying floors. Yours truly
C. L. Halstrom.*

Abram Cement Tool Co. Windsor
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W In a class **W**



S by themselves **Co.**

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are acknowledged by contractors and others to be the only practicable and durable wheeled scrapers made.

No other scraper has the heavy construction, spring back hooks, and reversible sleeve spindles and sand caps of the Western.

We have a catalogue waiting for you—send us your name and address.

Western Wheeled Scraper Co.

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Macadam Roads



*must be built
of a*

Tough Stone

*that
will cement*

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(Continued on page 16)

What Big Contractors

Say About This Koppel Car

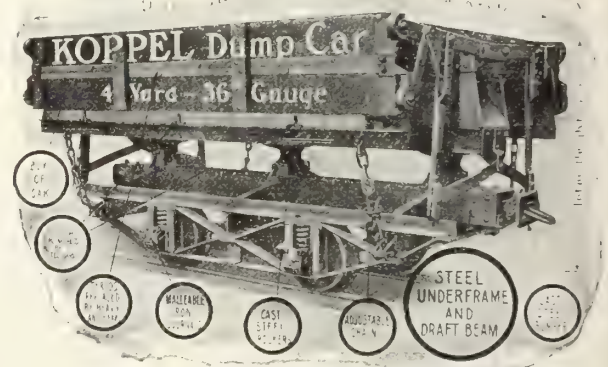
Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.



Orenstein-Arthur Koppel Co.

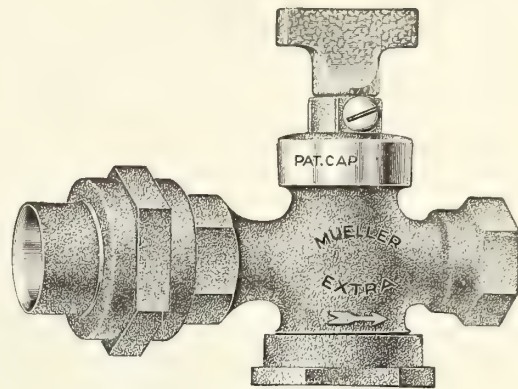
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Accordingly, Outremont in 1911 paved St. Viateur Street, as illustrated above, with tarviated macadam according to the modern pavement specification. The construction of the roadway cost less than \$1.00 per square yard including everything. The above photograph, taken in 1913, shows the road after two years' wear, still in ideal condition. There have never been any repairs to this street; the maintenance cost so far has been nothing.

The ideal method of maintaining this street in this same excellent condition will be to restore the surface when it gets worn, by a light coat of "Tarvia B" and stone screenings. With such an occasional treatment, this road—bonded and maintained with Tarvia—will give Outremont an ideal pavement for many years to come, at an annual average maintenance expense no higher than the expense for plain macadam.

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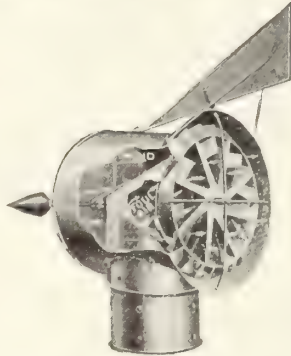
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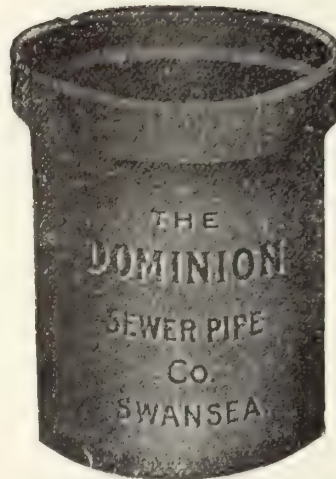
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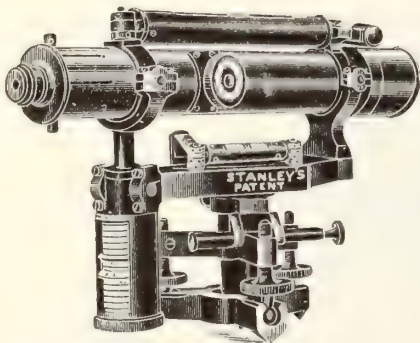
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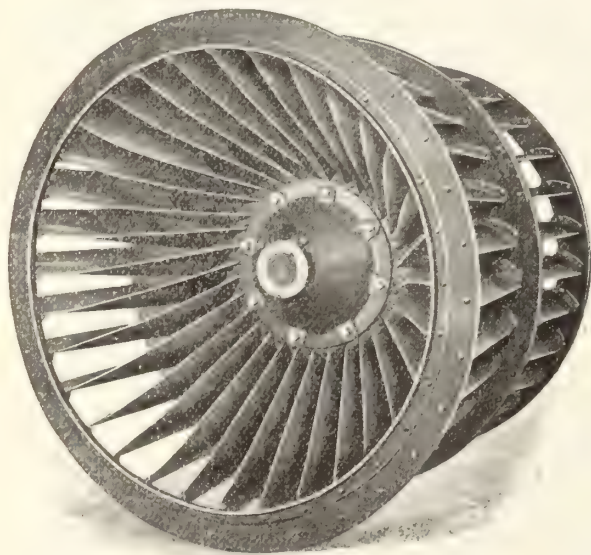
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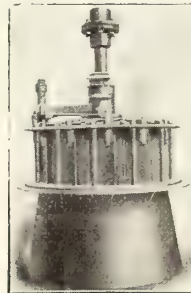
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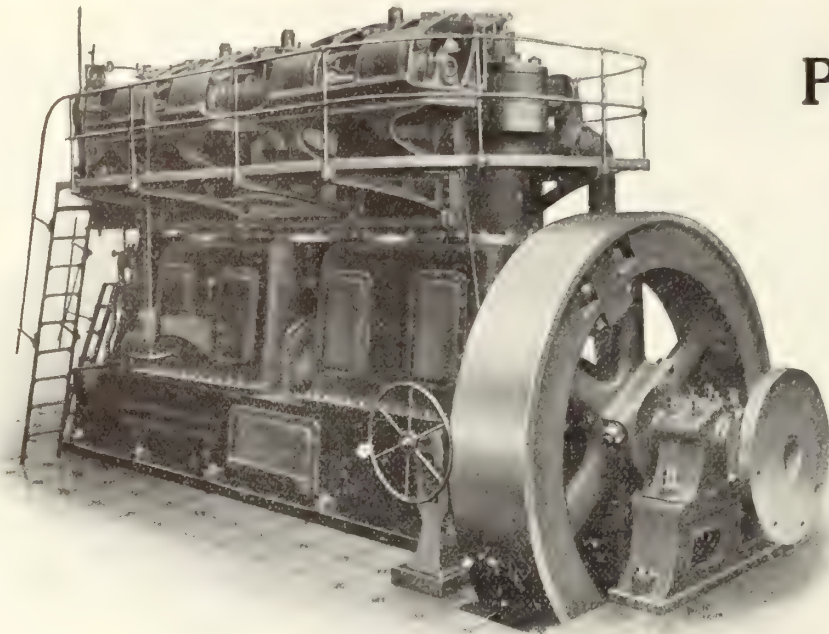
Water Wheels

The Samson wheel in official independent tests has shown very high efficiencies—reaching practically 90% (89.99). This is a guarantee that under your conditions our wheel will develop all the power possible, and give you results that cannot be surpassed by any wheel.

It is easy to install and to control when in operation and the workmanship, materials and performance are fully guaranteed.

Shall we send you our catalogue.

William Hamilton Company
Peterborough, Ontario



POWER WITH ECONOMY

"Mirrlees Diesel" Crude Oil Engines

SIMPLICITY
RELIABILITY
SAFETY
DURABILITY
and
Highest Efficiency
Combined in these Engines

Over 3,000 B. H. P. in Successful Operation in Canada to-day.

500 B. H. P. Engine as supplied to Moose Jaw Electric Railway. Now using 1,400 B. H. P.

BOVING & CO. OF CANADA LIMITED,

Head Office: 164 Bay St., Toronto.

Factory: Lindsay, Ont.

Moose Jaw: 13 Hochelaga St.

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No. 232

TOCH BROS.

"R. I. W."
REMEMBER IT'S WATERPROOF

EST. 1848

DAMP RESISTING PAINT

MANUFACTURED IN CANADA

INSULATES

CHECKS DAMPNESS

BONDS PLASTER TO BRICKWORK

Write for
Edition of "Red Book"

SAVES COST OF FURRING

R. I. W. DAMP RESISTING PAINT CO., TORONTO.

Office: 202 MAIL BUILDING, TORONTO

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Lawrence Hardware Co., Limited, Halifax, N.S.

—DISTRIBUTORS—

Western Paint Co., Winnipeg

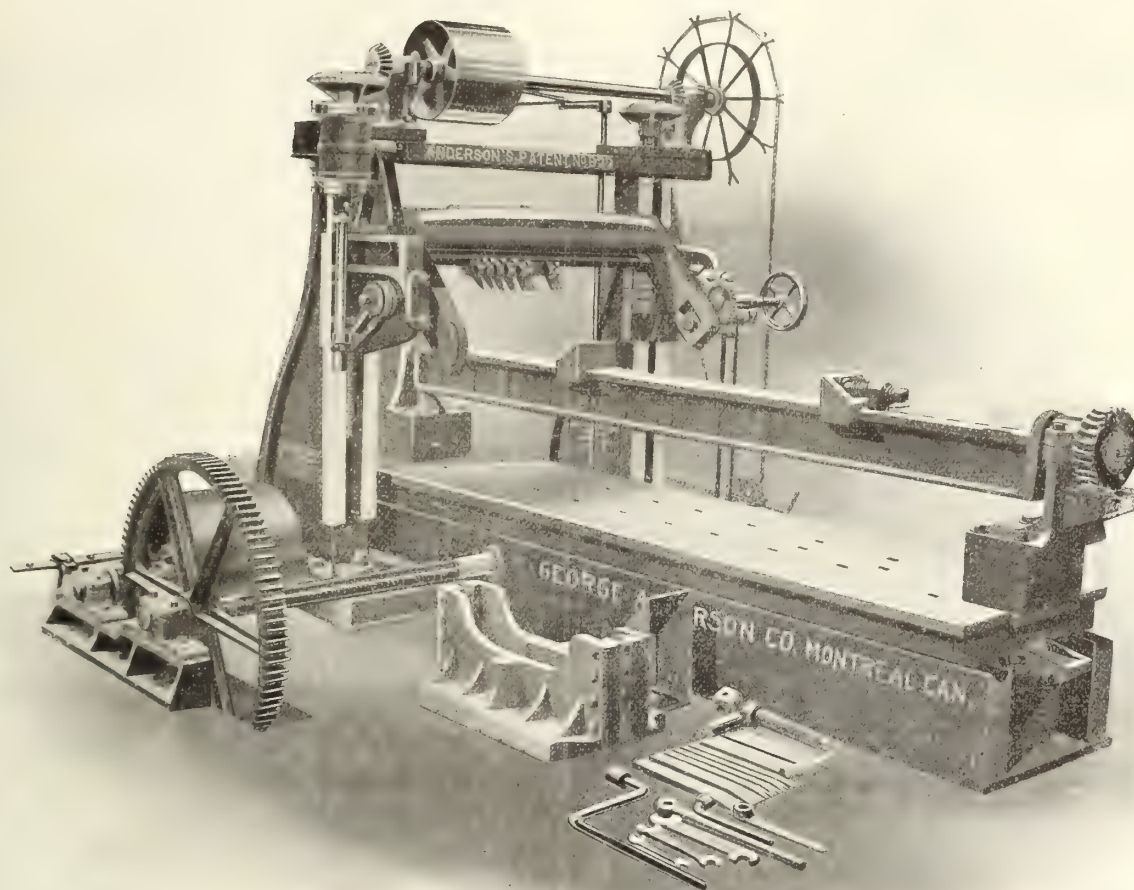
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Anderson's Patent Reversible Planer— Slide Type



Extensive experience shows that this Machine will do the work of at least eight men, and is easily 30% *faster* than the general types with single motion tables.

— OTHERS FOLLOW —

Cranes — Derricks

Geo. Anderson & Co. of Canada

Limited

Montreal, Que. and Carnoustie, Scotland

“BEATTY”

Material Handling Plant

Hoisting Engines

Clamshell Buckets

Steel Derricks

Derrick Irons

Centrifugal Pumps

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Steel Scows, Etc.

Your requirements for anything in this line can be promptly filled by us, for we have a big stock of finished plant ready for immediate shipment, so are in fine shape to serve you.

Let us know your needs—we can interest you.

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"THE BROWNHOIST LOCOMOTIVE CRANE gives perfect satisfaction"

says the owner of the crane shown here. This crane is being used with a 2 yd. Brownhoist Patent Grab Bucket for handling sand, gravel, and crushed stone from and to cars, stock-pile and wagons.

**Do you handle any
material?**

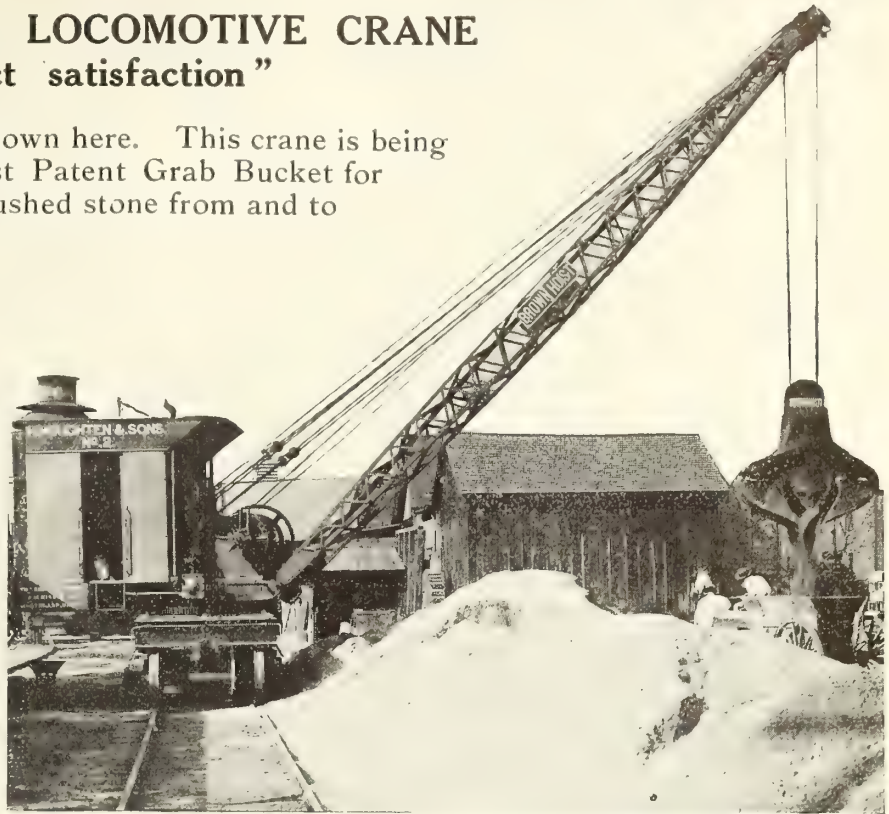
If so, write for catalog K which shows how and where the Brownhoist Locomotive crane and bucket are used.

**THE
BROWN HOISTING
MACHINERY CO.
Cleveland, O.**

New York
Pittsburgh

Chicago
San Francisco

The Colby Engineering Co.
Portland, Ore.



Note that the bucket is opened only so far and no sand is spilling over the sides of the wagon. This fine operation is obtained with all Brownhoist Locomotive Cranes and buckets.

Contractors' Equipments

We manufacture Electric Overhead Cranes, Electric Derricks, Winches and Capstans. Also Hand Winches, Tripods, Breast Derricks, Chain and Leg Lewises, Stone Hooks, Post Caps and Bases.



Illustration of a Standard Electric Overhead Traveller.
Capacity 5 tons. Girders Warren Braced Type.



Illustration of Electric Derrick. 6 tons capacity.
Boom 65 feet. Steel Boom and Steel Mast.

John T. Hepburn, Limited

IRON FOUNDERS, CRANE MAKERS AND MACHINISTS

18-40 Van Horne Street

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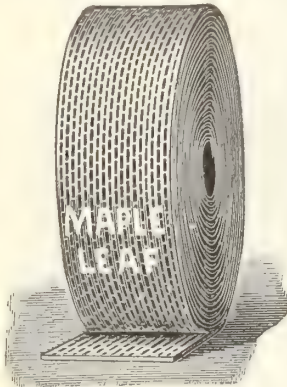
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Toronto

Looking for the "Maple Leaf"

Has Become a Habit with Superintendents and Engineers.

The reason is not hard to find, for there is no part of your Belting system, from the main drive to the smallest light Belt for power transmission, where you will not get the best kinds of service from



"Maple Leaf" Brand Stitched Cotton Duck Belting.

It is the most economical Belting because it is durable under every condition; even where other Belting will deteriorate rapidly. It is water proof.

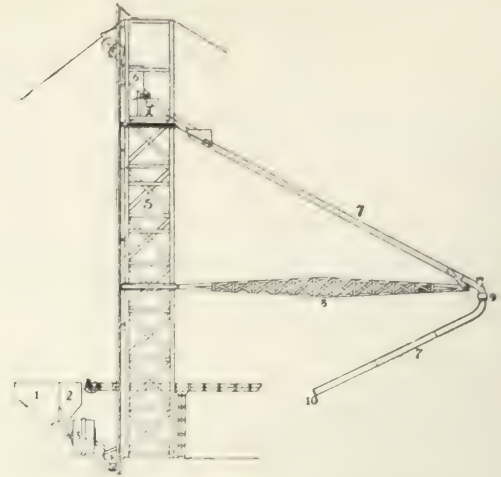
It runs absolutely true on the Pulleys.

It is built of plies of selected duck.

Write for Information and Prices.

DOMINION BELTING CO., LTD.

Hamilton, Canada



Gravity System Distributing Concrete

A system that improves the concrete and reduces the cost.

Information gladly furnished and Estimates given on any work.

Canadian Concrete Appliance Co. Limited

Sole Licensees for Canada

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CANADIAN SUPPLY & CONTRACTING COMPANY, Limited,
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STRUCTURAL WATERPROOFING
ENGINEERS AND CONTRACTORS

Let Us Tender on Your Roofing, Waterproofing and Flooring Specifications



CENTRAL TECHNICAL SCHOOL, TORONTO.

Ross & McDonald, Architects. Norcross Bros. Co., General Contractors. Waterproofing of Foundation Executed by Us.

We supply ROOFING, WATERPROOFING and INSULATING MATERIALS, and undertake contracts for Roofing, Waterproofing, Tar Rock and Mastic Asphalt Flooring. Our Complete Equipment enables us to execute the work in accordance with Architect's and Engineer's Specifications.

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House for Nurses
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Faced with
Hy-tex Bokhara Brick

There is one name by which you can identify QUALITY in every kind and style of the most desirable material for outside walls. It is

Hy-tex Brick

You want a brick you can identify—the maker's name makes him directly responsible to you. And Hy-tex is the only name which stands for universal quality in brick—and for that only.

All other brick trade-marks mean some one color or some one texture. The Hy-tex trade-mark means simply best brick. And there's a Hy-tex brick in every color and every texture known to brick-burning.

*Somewhere in the Hy-tex line
there is just the Brick you want.*

HYDRAULIC-PRESS BRICK CO.

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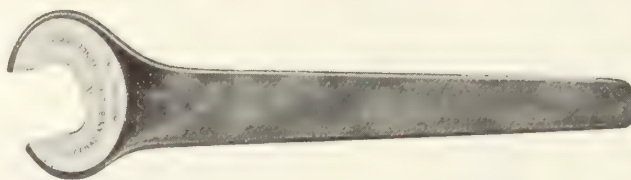
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TRADE MARK



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All types and sizes of
Standard Machine and Engineers Wrenches

Welland, Ontario

The Steel Company of Canada

LIMITED

Plain
Rounds
and
Squares

Twisted Steel Bars

FOR REINFORCING CONCRETE

Bands
and
Flats
all Sizes

Railroad Track Equipment, Invincible Fencing, Arm
Braces, Trolley Wire, Telephone and Galvanized
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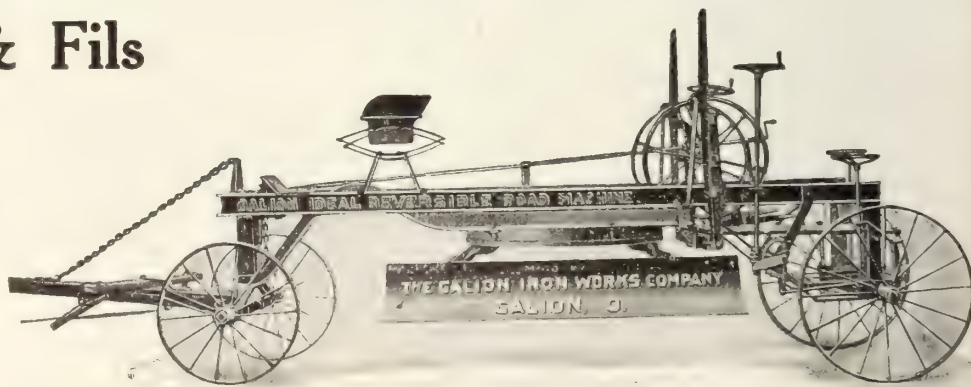
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J. B. H. Rickaby, Victoria, B.C.

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Road Graders, Rock
Crushers, Portable
Engines, Steam Road
Rollers, Sprinklers
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1845

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1914

Latest Manufacturers in America of
FIELD INSTRUMENTSfor Civil, Mining and Hydraulic
Engineers and Land SurveyorsTransits Current Meters Y Levels Leveling Rods
Compasses Chains Plane Tables Tape Lines

Also Makers of

Physical and Scientific Laboratory Apparatus
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Loading PlatformsThe
Gray Mfg. & Machine Co., Ltd.

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CANADA STEEL CO.
LIMITED
HAMILTON CANADA**STEEL**

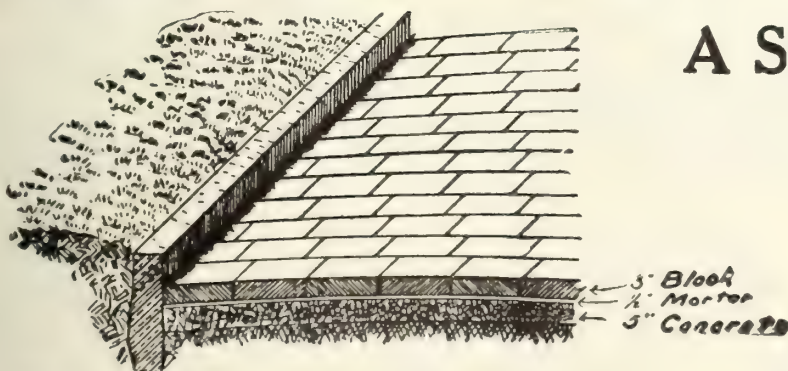
For Reinforcing Concrete

Plain Rounds Squares

Twisted Squares

Cross Arm Braces, Plain and Galvanized

We can ship from stock

*Ask for prices—they will interest you.***STEEL**Angles from $\frac{3}{4}$ x $\frac{3}{4}$ in. up to 2 x 2 ins.
Round and Square from $\frac{3}{8}$ in. up to
 $1\frac{1}{4}$ ins.Flats from $\frac{3}{4}$ in. up to 4 ins. in width,
and other special sections.Office and Works:
Sherman Avenue, North**A Scientific Pavement**

must be

Durable and Non-Abrasive.
Non-Absorbent and nearly Noiseless.
Unaffected by extremes of Temperature.
Sightly and Sanitary.
Easily Repaired and easily Cleaned.

These requirements are met by

Asphalt Block Pavements

Send for Descriptive Literature

The Ontario Asphalt Block Company, Limited - Windsor, Ont.



County Academy, Sydney, N. S. Built of Sydney Pressed Brick

Our plant is the only one of its kind in Canada making pressed brick from blast furnace slag. Brick made from this material is hard as flint—hardens with age and adheres with great strength to mortar.

Prices and Particulars on Request

Sydney Pressed Brick Co.
Limited
Sydney, Nova Scotia



New Code Rubber Covered Wires ^A_N_D Cables

Manufactured in accordance with specifications of the National Board of Fire Underwriters.

All our new code wire is inspected by the Underwriters Laboratories Inc. and have their inspection tags attached.

Stock carried at Toronto, Montreal, Winnipeg and Vancouver.

Price list and discounts on application to head office or nearest agent.

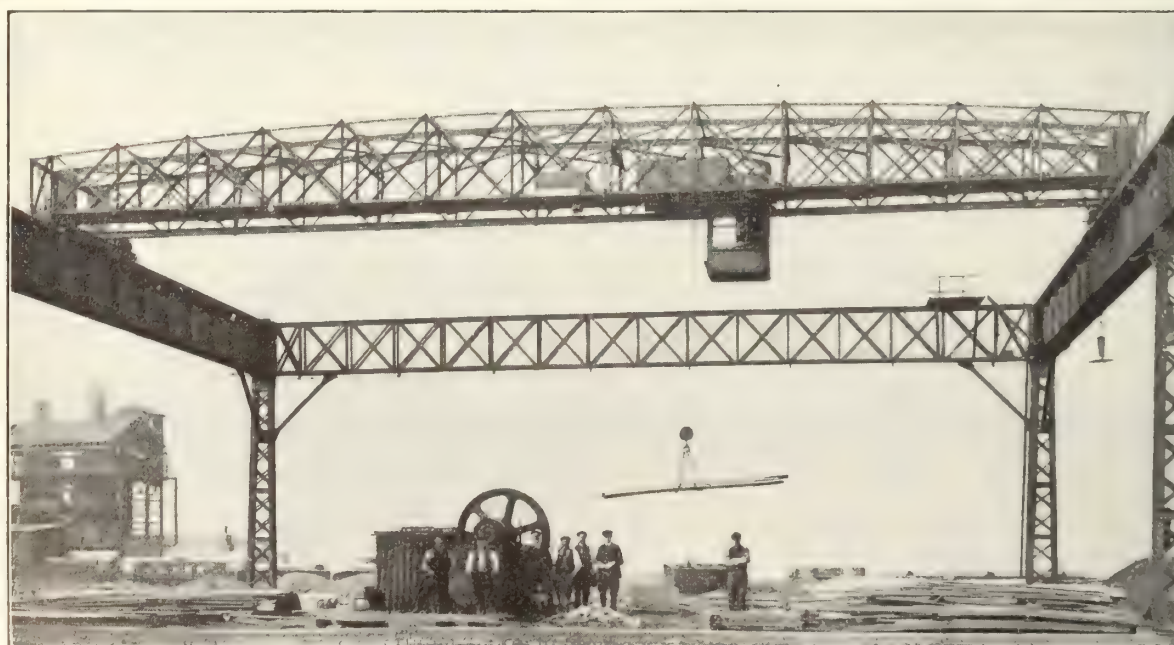
Canada Wire & Cable Co., Limited

1160-1170 Dundas Street

Toronto Canada

Sales Offices

401 Lake of the Woods Bldg., Montreal, Que.
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Macdonald, Marpole Co., Ltd., 427 Seymour St.,
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Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

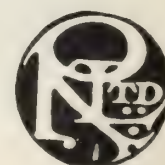
YOUR ENQUIRIES ARE SOLICITED FOR

CRANES TELFERS CAPSTANS WINCHES

ROYCE, LTD., Trafford Park, Manchester, England

Royce
Electrical
Cranes
Capstans
Telfers
Winches

Include
Royce
Crane Type
Motors,
Controllers,
Over
Hoisting
Safeguard.





More Accounts on the Profit Side of Your Ledger.

YOUR possible customers—there is a way to know who they are, what they require, and when they will be in the market for your products or services.

If you will get in touch with these thousands of possible customers and tell them your story in a personal way, many a new account will go into your ledger. **GET AFTER THEM WITH THE SURE ASSISTANCE OF MACLEAN DAILY REPORTS**—they are essential to successful selling.

Several hundred million dollars' worth of materials are being purchased each year by builders and constructors in Canada. Nearly everyone of these is a possible customer for you.

Are you sharing in these opportunities to the fullest extent? Are you getting in on the ground floor and getting your bids in early? Are you locating markets for your products in time to compete with your competitors?

MacLean Daily Reports will supply you with daily information of possible markets for the complete requirements of your business. As a keen business man you cannot afford to overlook this opportunity of helping yourself to a bigger business—of placing more accounts on the profit side of your ledger.

Let us send you complete information in detail, showing how our system will help your special line. Tell us the nature of your business and the provinces over which you wish to extend it and we will submit our proposition by mail

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Limited

220 King St. West,
TORONTO, CAN.

119 Board of Trade,
MONTREAL, QUE.

Travellers' Bldg.,
WINNIPEG, MAN.

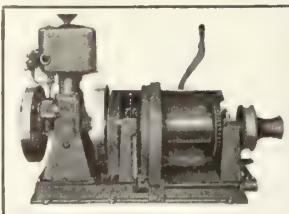
Hutchinson Blk.,
VANCOUVER, B.C.

Wanted: 2,500 Contractors

Who have had engine trouble
to read this advertisement
and write for catalog 314.

How Many

times has your engine stopped — broken down and held up your work?



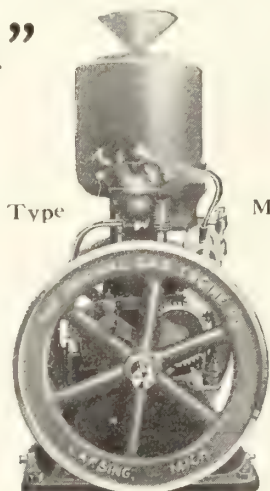
Every time, it's money lost. Can you afford to lose?

Suppose your equipment was driven by an engine which stood for "Constant Service" — "Engine Efficiency" — "Low Operating Cost."

How much would you save? Saving is the biggest feature of the

"Ideal"

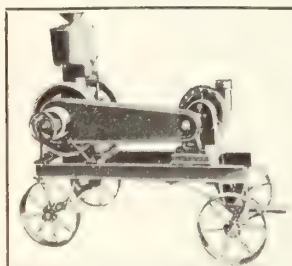
Fool Proof
Frost Proof
Dirt Proof
Enclosed
Crank Case
No Vibration
Large Valves
Self Oiling
Boxes



Get our
latest
catalog
for many
other
points.

Engines

"The Engine of many features"



Contractors who want "always on the job" machinery will do well to investigate

"Ideal" Hoists
"Ideal" Pumps

When buying equipment buy "Ideal" Power

Original Gas Engine Co.

R. Eolds, Chairman

500 Kalamazoo St. E.

Lansing

Michigan



Bay State
Brick and Cement Coating
"Lights like the Sun"
All Dark Places

on back streets, in air shafts, elevator wells, or inside rooms. Cuts down light bills. Also water proofs concrete and cement outside as well as inside. Write at once for our Booklet W. for suggestions on waterproofing and beautifying concrete construction.

WADSWORTH, HOWLAND & CO., Inc.

Paint and Varnish Makers and Lead Corroders

82-84 Washington Street - BOSTON, MASS.

Canadian Representatives:—Walter F. Gouinlock, 217 Confederation Life Bldg., Toronto, Can.; David McGill, 83 Bleury St., Montreal, Can.; Waite-Fullerton Co., Winnipeg, Calgary, Edmonton and Regina.



Steel without Copper (black—uncoated)

Same Steel with Copper (black—uncoated)

HERE IS THE PROOF That KEYSTONE COPPER BEARING STEEL

is more durable for Roofing purposes than Steel without copper

The above illustration shows the result of actual exposure to the weather. A series of similar tests all prove conclusively that Keystone Copper Bearing Steel is more durable for roofing purposes than ordinary steel or so-called "pure iron." Copper Bearing Steel can be supplied in both Black and Galvanized Sheets at but a slight increase in cost over ordinary steel.

Send for our booklet giving photographic illustrations of actual tests; you will find it very interesting.

United States Steel Products Company

NEW YORK, U. S. A.

Branch Offices: Winnipeg and Vancouver

SELLING AGENTS FOR EASTERN CANADA:

B. & S. H. THOMPSON & CO., Limited

Transportation Building, MONTREAL.

Traders' Bank Building, TORONTO

This is Elmhurst Avenue, Highland Park, Mich.

A Modern Concrete Pavement

Equipped With Baker Armored Expansion Joints
and Triangle Mesh Reinforcement



Do you know of all the epoch making advances in concrete road and pavement construction during the past year?

Write for our 1914 booklet and circulars—they are full of "up-to-the-minute-ideas" on concrete paving.

Baker Methods Always Lead

The R. D. Baker Co.

705 Whitney Bldg., Detroit, Mich.

Mixer Performance at Panama was Automatically Recorded by Mechanical Counters

All Austin Mixers in 1912 worked 3,118 eight hour days and mixed 1,209,506 cu. yds. of concrete or one cubic yard every $1\frac{1}{4}$ minutes—this is the average of all mixers from $\frac{1}{3}$ cu. yd. to 2 cu. yd. capacity.

All Austin Mixers in 1912 mixed 1,209,506 cu. yds. of concrete with a total of time lost for repairs of 302 hours or 1 hour per 4,000 cu. yds. of concrete mixed—this again is the average for all mixers large or small.

Two Austin Mixers have records of 225,000 cubic yards mixed each and they are still mixing; **two others** have records of 40,272 cu. yds. mixed each at a rate of $68\frac{1}{2}$ cu. yds. per hour per mixer; **four others** have a record of 5794 hours continuous work without a delay for mixers.

The Austin Cube will do equally good work for you.

Ask our Canadian Representatives.

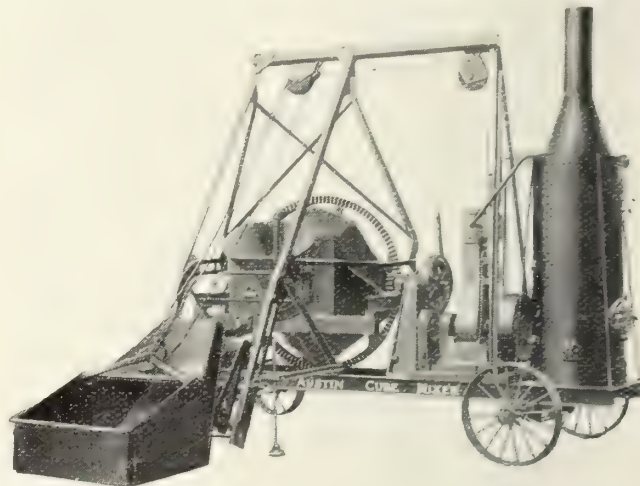
LECKY & COLLIS, Ltd., Napanee, Ont. and 335a Craig
St. West, Montreal, Que.

CANADIAN EQUIPMENT & SUPPLY CO., Calgary

E. G. CULLEN, Vancouver

Municipal Engineering & Contracting Co.

Main Office: Railway Exchange Bldg., Chicago, U. S. A.
Eastern Office: 90 West Street, New York City, U. S. A.



NOTE THE PERPENDICULAR POSITION OF THE Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, **each** gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch **in the air**—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that **does more work**.

So, to **PROVE** the working capacity of a KOEHRING we will place one in competition with **any** other mixer—to do **more** work size for size, or, to do as much work with a **smaller** mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO.

Toronto

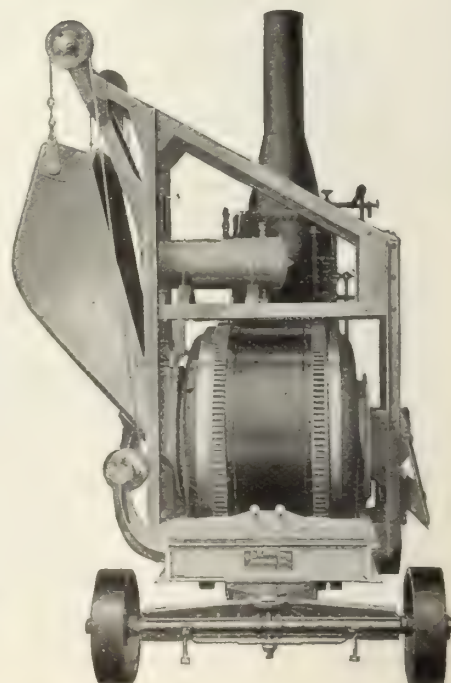
Winnipeg

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Buy the Brick of Proven Merit

By actual use in many structures and by scientific tests Harbour sand lime bricks have been proved an ideal building material.

Tests made at the University of Toronto at different times showed the crushing strength in pounds per square inch as: 4180, 4020, 4050, 4130. This is proof of uniformity in strength.

Harbour Brick Co., Limited
50 Front Street E.
Toronto



Dowling Ave. Highway Bridge Grand Trunk Ry., Toronto, Canada.
Waterproofed with J-M Waterproofing Materials

Our Engineering Department is at Your Service

We are Waterproofing Engineers—not merely manufacturers of waterproofing materials. Some of the largest and most difficult waterproofing jobs are being executed by our Contract Department. Our engineers will be glad to co-operate with you at any time.

The next time you are confronted with a waterproofing problem, large or small, you may feel perfectly secure in specifying

J-M Waterproofing Materials

The base of these materials is pure, natural asphalt, a waterproofing substance that gives lasting protection—regardless of climate and weather conditions. They will not crack, run, shove or disintegrate under any condition. Their life is practically everlasting.

Write our nearest branch for Booklet and full particulars.

The Canadian 2073
H. W. Johns-Manville Co., Limited
TORONTO MONTREAL WINNIPEG VANCOUVER

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office

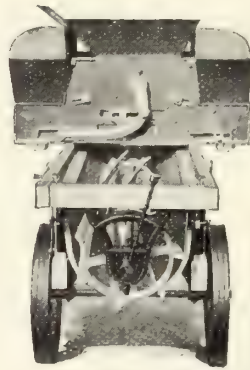
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-

New Glasgow, N. S.

**"I Have Built School Houses, Churches,
Dwellings, and Stores and in my
Six Years of Constant Use I Have Not Paid
Out Over \$10.00 for Repairs"**

—O. S. KELSO, Winnimac, Ind.



No. 12 Coltrin Mixer

The Knickerbocker Co.,
Jackson, Mich.
Gentlemen:—

Winnimac, Indiana, Jan. 13, 1914

The Coltrin Mixer that I am using I bought from Hagenbrush & Miller six years ago in March coming. They told me they had used it two years. They were using hand power. I put a 3 H. P. engine on it and have used it in all my work since, both in my factory and my foundation work. I have built school houses, churches, dwellings and stores, and in my six years of constant use I have not paid out over \$10.00 for repairs, and have made ten times that much renting out when I was not using it.

Respectfully yours,

O. S. KELSO.

Study the Mixing Method

Which has gained such a remarkable reputation of producing uniformly good
concrete at a minimum cost for

The Coltrin Continuous-Batch Mixer

Shipped anywhere on trial
See them at the

Feb. 12-21—CHICAGO CEMENT SHOW—Space 46-47

The Knickerbocker Co., Jackson, Mich.

Our 1914 Catalog is now ready for you

AZTEC ASPHALT

Refined by U.S. Asphalt Refining Co., New York

IS BY ALL STANDARD TESTS and practical demonstrations the superior asphalt for streets and roads. Its great cementing quality, high ductility and low susceptibility to extremes of temperature, together with stability, has placed it upon the highest plane in the sphere of asphalt.

This is evidenced by its large and successful use in many of the most important Cities and on State highways, as New York City (Boroughs of Manhattan, Bronx and Queens), Buffalo, Rochester, Philadelphia, Pittsburgh, Scranton, Baltimore, Washington, Toronto, Providence, Detroit, Norfolk, Raleigh, New York State Highways, Pennsylvania State Highways and New Jersey State Highways.

AZTEC LIQUID ASPHALT

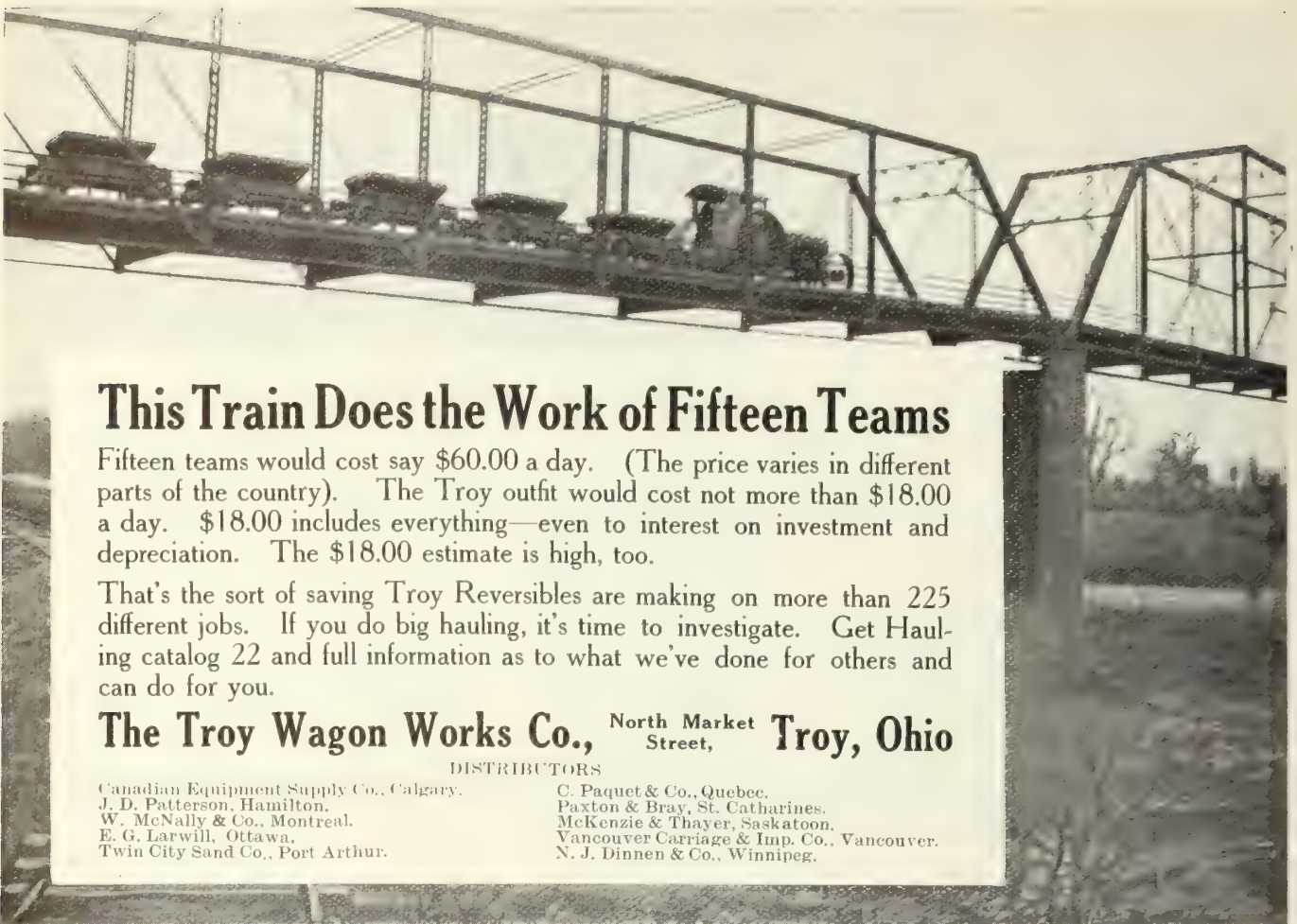
FOR OILING ROADS

For macadam, dirt and gravel roads, Aztec Liquid Asphalt provides the best and most efficient surface treatment. It is a pure, natural maltha possessing the necessary constituents to cause it to penetrate thoroughly the surface of a roadway. Upon evaporation there is left a hard asphaltic binder, which gives the road the appearance of a sheet asphalt pavement.



The great demand for Aztec Liquid Asphalt this season is the result of the experience and recommendation of those who have previously used it.

Aztec Oil & Asphalt Refining Co. of Canada
137 McGill Street, Montreal



This Train Does the Work of Fifteen Teams

Fifteen teams would cost say \$60.00 a day. (The price varies in different parts of the country). The Troy outfit would cost not more than \$18.00 a day. \$18.00 includes everything—even to interest on investment and depreciation. The \$18.00 estimate is high, too.

That's the sort of saving Troy Reversibles are making on more than 225 different jobs. If you do big hauling, it's time to investigate. Get Hauling catalog 22 and full information as to what we've done for others and can do for you.

The Troy Wagon Works Co., North Market Street, **Troy, Ohio**

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Canadian Equipment Supply Co., Calgary.
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W. McNally & Co., Montreal.
E. G. Larwill, Ottawa.
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C. Paquet & Co., Quebec.
Paxton & Bray, St. Catharines.
McKenzie & Thayer, Saskatoon.
Vancouver Carriage & Imp. Co., Vancouver.
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—8 Arrangements - 1 Fan - 1 Cost—

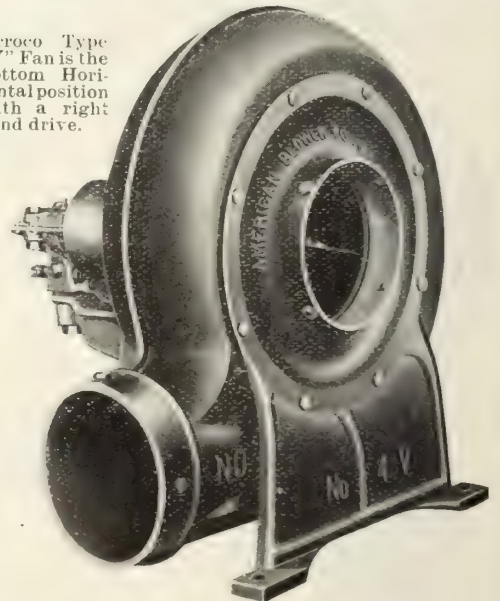
Sirocco
TRADE MARK.

Type "V" Universal Fans

Just take out a few tap bolts—swing the housing around to the angle desired—put the bolts back and all is ready. You can do the same thing 8 times with the same machine—is not this reversibility convenient, also profitable to you?

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 Architect.

Fred Holmes & Sons, Limited,
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Contract Record

ESTABLISHED 1856

and Engineering Review

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The Work and Opportunities of the Canadian Society of Civil Engineers

THE outstanding event of the past week was the annual meeting of the Canadian Society of Civil Engineers in Montreal, reported elsewhere in this issue. The occasion was the twenty-eighth annual convention. In many respects it bore a marked resemblance to the twenty-seventh annual meeting, the twenty-sixth annual meeting, the twenty-fifth annual meeting and others well within our recollection. Enough comments have been made about this sort of thing, however, to cause us to refrain from taking any further part in the discussion of matters with which we are identified only in the

interests of a section of our readers. Last year we were particularly impressed by certain things, and we said so editorially, receiving in response a large number of communications from members of the Society ranking from past-presidents to juniors. Whether or no the discussion to which we refer bore any good fruit may be doubtful in the minds of some, but the fact remains that the subject matter of the discussion provided the basis of the presidential address reprinted on another page.

We believe that the Canadian Society is doing excellent work. This, in fact, is evidenced by the able reports submitted at the meeting—expert reports from which emanated only too little discussion. But there is still room for improvement—witnessed not by the Contract Record alone, but by so active a member of the Society as Mr. H. H. Vaughan, who at the very last session of this convention which has just passed into history counselled those present to endeavor to make their annual meetings worthy of a gathering of engineers, and to spend the greater part of their time in the discussion of technical matters, not in trivial altercations. We feel sure that the great majority of the members will concur in this view, and we cannot but think that the same majority would characterize as unprofessional the frivolities of one or two individual members at the Montreal convention. The convention hall is no place to recount anecdotes and such procedure only cheapens an event which should prove an annual inspiration to every member of the profession. It cannot be urged too strongly that the Canadian Society of Civil Engineers is guiding the destinies of what should be one of the most important professional communities in the country, and the responsibilities of this body cannot be taken too seriously, a point which received proper emphasis at the Convention at the hands of Mr. McNab.

We are entirely in accord with Mr. Vaughan in the opinion that the business procedure of the convention should be disposed of on the first day, so that two days could be set apart for professional experiences. We believe that herein, in the past, great opportunities have been lost.

The attention drawn by the retiring president, Mr. Johnson, to the inadvisability of fanning the flame against the admission of foreign engineers is timely, in a broad understanding. However we may deceive ourselves, we have not yet attained to national manhood, and the helpful experience of the older countries must continue to serve us in good stead in our larger problems, strongly though we resent it. All other things equal, the Canadian-born engineer is entitled to claim preference on government work, but only in such a case—and how often, or rather how seldom, are all qualifications on a parity but the place of birth! It would be a sign of hopeless ignorance to reject the most advanced ideas that outside engineers have to offer, in favor of our own limited practice, merely with a view to protecting individual interest. Is there not something anomalous in the whole thing, seeing that in the past Canada has been dependent to such an extent upon outside sources of aid, whether structural or financial?

The Society is to be congratulated upon Mr. Butler's succession to its presidency. As a former chief engineer of the Department of Railways and Canals, later Chairman of the Board of Management of the Canadian Government Railways, later again General Manager of the Dominion Steel Corporation, and now the executive head of the firm of Messrs. Armstrong,

Whitworth of Canada, Limited, Mr. Butler has a long experience, and a breadth of vision gained therefrom, which cannot but be of inestimable value in the Society's work.

Not a few of the members will acclaim the fact that next year will break the chain of annual conventions in Montreal. Commercial metropolis though it may be, there is nothing particularly lovable about Montreal during a January thaw. We believe that a change of venue will result in "increased enthusiasm."

The Canadian Clayworkers' Convention

IN another column will be found a report of the Twelfth Annual Convention of the Canadian National Clay Products Association, held last week in Toronto. The meeting was perhaps the most successful of its kind ever held in Canada and the clayworkers are to be congratulated upon the fruits of their enterprise.

In his report the President, Mr. Charles A. Millar, spoke in most encouraging terms as to the increased activities in most of the brick and other clay products plants and made the gratifying announcement that negotiations had been completed for establishing a course in Ceramics at the Toronto Technical School. An exceptionally good programme of practical papers was contributed by, amongst others, Professor Coleman, Mr. Joseph Keele, Dominion Geological Survey; Professor Orton, Jr., Dean of Engineering, Ohio State University; and Professor W. H. Day, Ontario Agricultural College, Guelph. The convention was well attended throughout, and the exchange of ideas which resulted from the discussions cannot fail to have a very beneficial effect in the further development of the industry.

Building Returns for the Dominion

RETURNS of building progress throughout the Dominion during the past year are instructive as affording an indication of the volume of construction compared with the previous twelve months. An intelligent study of the figures is sufficient to reveal the fact that behind the gloom which hangs over the industrial world there is beginning to emerge the silver lining which would appear to bear hopes of a bright period of building activity. The total value of building permits issued in 1913 in fifty cities of Canada was \$167,518,614, compared with \$201,161,550 in the preceding year. Coming to the provinces we find that in the nineteen cities of Ontario for which records were available there was practically no change in the aggregate, the value of permits for 1913 being \$51,546,101, as against \$51,486,204 in 1912. The returns for Quebec province are \$35,245,345 for 1913, as against \$26,433,889 in the previous year, an increase of \$8,801,456. For the Maritime cities, Halifax, Sydney and St. John, the figures are \$3,537,708, an advance of \$1,725,622 over the previous year's total of \$1,812,086. The western provinces, Manitoba, Saskatchewan, Alberta and British Columbia, all show substantial decreases as compared with 1912, the totals being:—Manitoba, \$19,660,490 in 1913, as against \$21,815,262, decrease \$2,154,772. Saskatchewan, \$16,584,485 in 1913, a decrease of \$9,567,232 in the previous year's total of \$26,151,701. Alberta, \$22,367,379, as against \$39,424,525, which represents a reduction of \$16,057,144. Toronto still maintains its position at the top of the list, with permits valued at \$27,038,624, but Montreal is a close

second, with Winnipeg, Vancouver, Edmonton and Calgary following in order as to actual total. A remarkable feature of construction in the Maritime provinces is the activity of St. John, N.B., where the permits totalled in value nearly two million dollars in excess of 1912, while a noteworthy increase is also recorded for the province of Quebec. On the other hand, heavy declines are reported from every point in the western provinces with the exception of two or three cities, of which Medicine Hat has the best record. The greatest set-back has taken place in British Columbia, the city of Vancouver in particular faring badly in the general depression. In value of building done Winnipeg occupies a high place not only in the Dominion but in relation to the whole continent. Among Canadian cities the capital of Manitoba takes third place on the list, while there are only five cities in the United States which show a larger total for the year.

These figures, though they show a notable decrease in the aggregate, are at the same time instructive as indicating steady growth in the development that has taken place in comparison with previous years. On every side we hear encouraging reports of the gradual clearing of the industrial horizon, of immense constructional undertakings already planned in practically every part of the Dominion, whilst a feeling of optimism prevails among building contractors generally. With these indications of renewed progress, and the gradual easing up of the money market, we predict with confidence the speedy arrival of a period of unexampled prosperity.

Improvised derrick cars were recently used in the erection of moderate-span single-track deck plate-girder bridges in New Mexico. Each of two ordinary flat cars was provided with a timber tower about 10 ft. high, built over the truck at one end and slightly overhanging the car. Tackles were suspended from these towers, and the latter, being brought up to opposite ends of the completed span, lifted it clear and carried it between them across the falsework to the required position on the line. The falsework was then dropped down, giving clearance for the span to be lowered to permanent position, and the track restored to service with a very short interruption of traffic. The construction of the temporary towers on the flat cars cost less than \$200, thus making an economical arrangements which might easily be available under conditions where the services of derrick cars could not be advantageously secured.

The problems of building construction in India are described in an American consular report, which states that one of the most significant recent developments in connection with the construction of large buildings in India has been the increasing use of American reinforcing steel for concrete construction and of various American roofing materials. The use of reinforcing bars has greatly increased economy in the construction of buildings in India. Many houses fall every year during the heavy rains at the break of the monsoon, and as a result chiefly of the disasters, there is now much more rigid official inspection of building operations in the leading cities. Possibly, says the consul, there would be a field in India for architects and building contractors who might introduce more efficient and economical methods, and thus make buildings cost much less and give more safety and comfort.

Civil Engineers in Session at Montreal

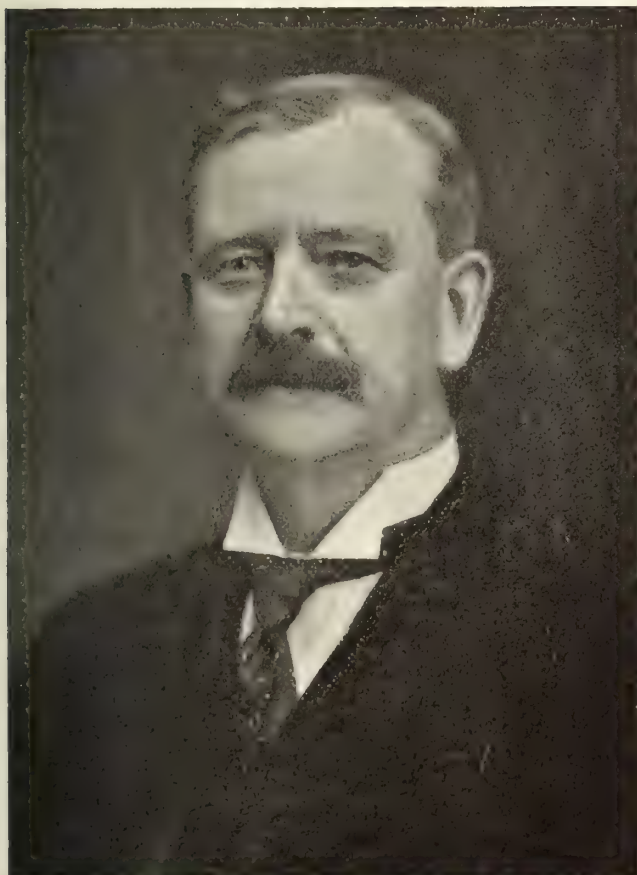
Proceedings of the Twenty-Eighth Annual Meeting—Satisfactory Reports Submitted by Branches and Various Committees—A Representative Gathering

THE Twenty-Eighth Annual Meeting of the Canadian Society of Civil Engineers was held last week in the Society's new headquarters at 176 Mansfield street, Montreal. The registered attendance was 331, the membership being drawn from the Maritime provinces in the east to the Pacific Coast in the west, from many points in the United States, and even from England. A number of those who have occupied the highest place in the Society in the past attended the meeting, notably three past-presidents—Lt.-Col. Anderson and Mr. Geo. A. Mountain, of Ottawa, and Mr. C. H. Rust, of Victoria, B.C. Con-

gineering Record and Engineering News respectively. The Old Country was represented by Mr. H. M. Lyon, of Stafford, Eng.

Visiting Members

L. E. Allen, Ottawa;	J. T. Johnston, Ottawa;
Arthur Amos, Quebec;	A. M. Jones, Ottawa;
A. A. Anderson, Ottawa;	Newton J. Ker, Vancouver, B.C.;
Wm. P. Anderson, Ottawa;	J. G. G. Kerry, Toronto;
J. D. Armstrong, Ottawa;	George Kydd, Campbellford;
F. C. Askwith, Ottawa;	A. Lainglois, Ottawa;
H. B. Aylmer, Melbourne, Que.;	H. F. J. Lambart, Ottawa;
Frank A. Barbour, Boston Mass.;	Wilfred D. Lawson, Ottawa;
H. E. Bates, Neilsonville, Que.;	A. Leofred, Quebec;
W. W. Benny, Ottawa;	E. E. Little, Ottawa;
F. X. T. Berlinguet, Three Rivers;	Hugh A. Lumsden, Winnipeg;
Alex. Bertram, Dundas, Ont.;	H. M. Lyon, Stafford, Eng.;
R. A. Black, Quebec;	Geo. D. MacKinnon, Sherbrooke;
W. E. Blue, Ottawa;	W. M. MacPhail, Winnipeg;
Thos. Breen, Quebec;	Duncan MacPherson, Ottawa;
W. Lyon Browne, Westmount;	O. Marien, Outremont, Que.;
Howard Brunlees, Ottawa;	D. F. Maxwell, Fredericton, N.B.;
H. C. Burchell, Sydney, N.S.;	G. A. McCarthy, Toronto;
H. D. Cameron, Winnipeg;	Norman M. McLeod, Toronto;
J. M. Campbell, Ottawa;	F. C. Mechin, Toronto;
J. B. Challies, Ottawa;	L. F. Merrylees, Quebec;
S. J. Chapleau, Ottawa;	C. H. Mitchell, Toronto;
Willis Chipman, Toronto;	S. P. Mitchell, Philadelphia, Pa.;
E. S. Clements, Toronto;	Frank Moberly, Barrie, Ont.;
P. C. Cody, Ottawa;	P. E. Moffat, Ottawa;
R. de B. Corriveau, Ottawa;	Romeo Morrisette, Three Rivers;
C. R. Coutlee, Ottawa;	Geo. A. Mountain, Ottawa;
G. C. Coutlee, Ottawa;	C. E. Mundell, Boston, Mass.;
A. Crumpton, Port Hope;	Wm. Murdoch, St. John, N.B.;
R. R. Decary, Quebec;	C. M. Odell, Sydney, N.S.;
H. Dessaulles, Shawinigan Falls;	E. W. Oliver, Toronto;
H. McM. Dibert, Troy, N.Y.;	Stuart S. Oliver, Quebec;
W. J. Dick, Ottawa;	R. E. Paget, New Hazelton, B.C.;
A. A. Dion, Ottawa;	Harry A. Paquette, Levis, Que.;
R. L. Dobbin, Moose Jaw, Sask.;	C. R. Partik, Ste. Agathe, Que.;
G. Blanchard Dodge, Ottawa.	H. McL. Pepper, Springhill, N.S.;
J. F. Earl, Calgary;	C. H. Pinkey, Ottawa;
A. C. Fellows, Quebec;	W. M. Reid, Westmount;
G. H. Ferguson, Ottawa;	J. A. Robert, Ottawa;
A. Douglas Fiskin, New York;	W. H. Robert, Beauharnois, Que.;
A. Fraser, Quebec;	James Robertson, Lachine, Que.;
A. E. French, Boston, Mass.;	Geo. E. Roehm, Walkerville, Ont.;
John S. Galbraith, Toronto;	Richard B. Rogers, Peterboro;
G. H. Garden, Maberly, Ont.;	R. M. Roy, Hamilton;
L. W. Gill, Kingston;	C. H. Rust, Victoria;
E. P. Goodwin, Baie Verte, N.B.;	H. P. Rust, New York;
Alex. J. Grant, Peterboro;	P. V. Schmitt, New York;
Alex. Gray, Ottawa;	T. H. Schurtzer, Ottawa;
J. W. Harkom, Melbourne, Que.;	Frank W. Skinner, New York;
John Lyle Harrington, Kansas City;	Geo. W. Smith, Milwaukee, Wis.;
J. B. Harvey, Lyndhurst;	J. Tessier, Quebec;
H. E. T. Haultain, Toronto;	J. A. Tremblay, Montmagny;
M. C. Hendry, Ottawa;	R. F. Uniacke, Ottawa;
C. S. L. Hertzberg, Toronto;	G. W. Volkman, Ottawa;
A. E. Hodgins, Victoria, B.C.;	James White, Ottawa;
A. R. Holmes, Sherbrooke, Que.;	E. T. Wilkie, Toronto;
J. P. Howe, Cochrane, Ont.;	Geo. R. J. Wilson, Vankleek Hill;
T. C. Irving, Jr., Toronto;	H. S. Windeler, St. John, N.B.;
Hyndman Irwin, Toronto;	M. Wolff, St. Casimir, P.Q.
F. C. Jewett, Campbellford;	



Mr. M. J. Butler, of Montreal, the newly-elected President of The Canadian Society of Civil Engineers.

sulting engineers were there in force, but the representation of the municipals was practically in the hands of City Engineer Murdoch, of St. John, N.B., and City Engineer Rust, of Victoria. Local members of the profession in all departments were in strong evidence at the convention. The following is a list of visiting members, the complete list of members in attendance having already been published in various forms. Included in the list is the name of a former contributor to the Contract Record from Kansas City, Mo., namely, Mr. John Lyle Harrington, of the firm of Messrs. Waddell & Harrington. The extent of the recognition of the Society in the United States is evidenced by the attendance of Messrs. F. W. Skinner and P. V. Schmitt, editorial representatives of the En-

The opening session was held on the morning of Tuesday, January 27, with the president, Mr. Phelps Johnson, of Montreal, in the chair. The business to be transacted was the nomination of scrutineers and the reception and discussion of the reports of the various committees. The report of the Society's financial standing showed a surplus of \$646, a large proportion of the expense account constituting a payment of \$50,000 for the new building, upon which a liability of \$20,000 still remains.

The report of the Committee on Concrete and Reinforced Concrete was submitted by Mr. Walter J. Francis, chairman, with whom were associated in the preparation of the report the following gentlemen: Messrs. S. Baulne, E. Brown, E. Brydone-Jack, J. Galbraith, P. Gillespie, H. M. MacKay, E. S. Mattice, C. N. Monsarrat, M. Morssen, P. B. Motley and H. Rolph. There was considerable discussion of this report. Mr. Francis moved that it be received and that the committee be continued. Replying to Mr. Brown he ex-

plained that in the preparation of their data the committee had followed the most advanced practice of the United States, Great Britain and continental countries. Mr. Elmont urged that the specifications for concrete and reinforced concrete should be separated in the published form. After suggesting various modifications, Mr. Elmont concluded by advocating a reduction in the allowable stress of reinforced concrete. The committee will make a final report at the next annual meeting.

Practical Recommendations of Reinforced Concrete Committee

The following is an extract on Workmanship culled from the report of the Committee on Reinforced Concrete which contained a draft of standard general specifications. Embodied in the extract are the latest modifications and corrections of the Committee.

MORTAR AND CONCRETE

Foundations.—The foundations shall be trimmed as accurately as practicable and shall be at least as large as the dimensions on the approved drawings. Form work shall be erected wherever foreign material can become mixed with the concrete or mortar while the same is being deposited.

The bearing stratum shall be cleaned of all foreign material. It shall also be free from water if practicable. Under no circumstances shall mortar or concrete be deposited in running water.

Form Work.—Form work shall be substantially and accurately constructed. It shall be plumb and true to line, well fixed, braced and supported to carry the imposed loads, and be rigid enough to retain proper alignment and correct contours until the concrete will have become well set. Form work shall be sufficiently tight to prevent leakage. Immediately before depositing concrete the form shall be carefully cleaned out, after having been finally trued up. A thin even coating of soft soap or oil may be applied to new forms. Such a coating shall be applied in every instance where form work is to be used more than once. Form work that has been previously used shall be thoroughly cleaned before re-erection and given a protecting coat of the same material as that already used on it. Form work shall be so fastened together that it may be removed without injury to any part of the permanent structure.

Storage of Cement.—Cement shall be stored in a weather-tight ventilated building. The floor of the building shall be raised above the ground to ensure dryness.

The cement shall be neatly piled in carload lots in the original sacks, and be marked in a distinctive manner for identification purposes.

Storage of Sand, Crushed Stone and Gravel.—All sand, crushed stone and gravel shall be piled on a site which has been cleaned free from vegetable and other foreign materials.

Measuring of Ingredients.—One sack of cement containing 87½ pounds net shall be taken as equivalent to one cubic foot of cement. All sand, crushed stone and gravel shall be measured by loose volume.

The necessary amount of water to produce the required consistency of mortar or concrete shall be determined from time to time taking into account the atmospheric conditions and the variations of moisture in the sand, crushed stone or gravel before mixing.

All of the materials shall be systematically measured throughout the whole of the work, and the required proportions shall be accurately maintained.

Mixing of Ingredients.—All mortar and concrete shall be made in batch mixers unless it is impracticable to do so, in which case it shall be mixed by hand.

Mixing by hand shall be done on a smooth water-tight platform. The sand and cement shall first be mixed dry

until the whole mass is homogeneous and of perfectly even color throughout. Sufficient water shall then be added to make flowing mortar. In the process of making the mortar the materials shall be turned over at least five times. If concrete is to be made wetted the crushed stone or gravel shall then be added and the whole mass turned over at least four times and until it has become homogeneous and of even color and consistency.

Mixing by machine shall produce a homogeneous mass of concrete perfectly uniform in color and even in consistency, the whole mass shall be in continuous motion within the machine for a period of not less than one minute, and the entire batch shall be discharged before any further materials are placed in the machine.

The re-mixing or re-tempering of mortar or concrete which has partly set shall not be permitted.

The general consistency of the mortar or concrete shall be such that the mass will flow readily in the forms, and that it can be conveyed from the mixer to the forms without separation of the ingredients.

The temperature of the mixture on completion of the mixing shall not be less than 40 deg. Fahrenheit. The water, sand and crushed stone or gravel shall be heated, if necessary, to obtain this result. In no case shall crystals of ice either in the sand or in the crushed stone be permitted to reach the mixing platform or the mixing machine.

Placing Above Water.—The surface on which concrete is to be deposited shall be specially cleaned for the purpose. If the surface be rock it shall be given a coat of grout composed of equal parts of cement and sand well brushed into the surface and all the crevices. If the surface, vertical or otherwise, be of concrete which has set hard it shall be spalled or roughened and afterwards thoroughly brushed over with grout composed of equal parts of cement and sand. If the surface be of concrete which has not set hard the spalling or roughness may be omitted, but grout composed of equal parts of cement and sand shall be applied as specified above.

Mortar and concrete shall be placed immediately after being mixed.

Mortar or concrete which has partly set shall not be used.

Concrete shall be conveyed in water-tight carriers and be deposited in such a manner that the ingredients will not be separated, and the mass shall be consolidated by being worked after placing. The coarser ingredients shall be removed from contact with the formwork by the manipulation of a special tool.

The depositing of concrete at expansion joints shall be done with the same care and attention as that required to ensure a smooth finish to exposed surfaces.

In all cases laitance which may have formed on the surface of deposited concrete shall be carefully and entirely removed.

Concrete shall be deposited in approximately horizontal masses, and the work shall be stopped only at regular or temporary vertical bulkheads.

Arch rings shall be built in sections of such lengths as will permit of all concrete in any one section being placed without stopping. If circumstances render this impracticable, bulkheads shall be placed normal to the line of pressure.

In building bench walls or abutments of arches, the tops of such walls shall be finished normal to the line of pressure, and no horizontal joints shall be made.

During freezing weather concrete shall be taken from the mixer and deposited in the forms so that no part of it shall be frozen and the temperature of the mass when deposited shall not be less than 35 deg. Fahrenheit. The concrete shall be prevented from freezing until setting has taken place and until the process of hardening has begun.

Trowelled or floated horizontal surfaces shall be not less than one inch in thickness. They shall be composed of mor-

tar or concrete proportioned according to the requirements for wear. The mortar shall contain at least one part of cement to one part of sand and one part of finely crushed rock or gravel.

If possible the surfacing shall be applied immediately after the placing of the mass concrete, but when this is impracticable the mass concrete shall be thoroughly washed and treated with a coat of grout composed of equal parts of cement and sand thoroughly brushed in before the surfacing is applied. In trowelling or floating the surface pure cement shall not be used.

Curing.—Concrete shall be protected from the direct rays of the sun for at least three days after being deposited when the maximum temperature is above 60 deg. Fahrenheit in the sun.

For a period of seven days after being deposited concrete shall be kept moistened when the maximum temperature in the shade is above 60 deg. Fahrenheit.

Form Removal.—The forms shall not be removed from concrete work until the concrete is safely self-supporting, and, where additional concrete is to be added, until it has sufficient strength to safely sustain the superimposed load.

Placing Under Water.—When concrete is to be deposited under water the site shall be cleaned from all foreign matter and all currents of water shall be eliminated. The concrete shall be deposited immediately after mixing in such a way as to displace the water and at the same time to obviate the separation of the ingredients. The work shall be carried on in such a manner as to prevent the formation of laitance between successive masses of concrete.

REINFORCED CONCRETE

General.—All the requirements of the preceding sections shall apply to reinforced concrete as far as consistent.

Crushed Stone and Gravel.—The largest fragments of crushed stone or pieces of gravel for reinforced concrete shall be of such a size as to pass through a circular hole $\frac{3}{4}$ -in. in diameter in a thin plate.

Storage of Steel.—Steel shall be stored on skids clear of the ground and protected from rain and snow.

Fabrication and Placing of Steel Reinforcing.—All steel reinforcing shall be fabricated and placed in strict conformity with the dimensions of the approved drawings, and it shall be truly lined up and so held in position that displacement shall not occur during the depositing or manipulation of the concrete. All bars shall be free from bonds not specifically required by the approved drawings.

No material shall be permitted to adhere to the surface of the steel reinforcing until the concrete in which it is to be embedded is being deposited.

Cleaning of Form Work.—Immediately before depositing the concrete the form work shall be entirely cleaned of all foreign material, preferably by the use of a pressure hose and nozzle discharging water, steam or air.

In column forms an opening shall be provided at the bottom of the form work of every column in order that every particle of foreign material may be readily removed.

Depositing of Concrete.—The concrete shall be deposited in small quantities preferably as a uniform stream. It shall be manipulated in such a manner as to ensure perfect adhesion to the entire surface of the steel reinforcing and to remove all impounded water or air.

In depositing concrete in columns the work shall be discontinued at the elevation of the bottom beams for a period of not less than three hours before depositing the beam concrete. In the absence of beams the elevation of the bottom of the slab shall be taken as the stopping place. Before commencing the depositing of the beam concrete (or slab concrete in beamless systems), every column shall be exam-

ined for laitance, which if present shall be immediately removed.

The concrete for slabs shall be deposited continuously with the beams. Special care shall be exercised to procure perfect homogeneity of tee-beam construction.

Discontinuance of Work.—Every structural element shall be completed without discontinuance if practicable. Unless completed in one operation, beams and slabs shall be discontinued only by the use of vertical bulkheads placed at the section of maximum bending moment.

Freezing Weather.—In protecting reinforced concrete from frost a system which will drive the moisture out of the concrete shall not be used.

Form Removal.—The forms shall not be removed until the times named in the following table have elapsed after depositing concrete, not counting periods in which the temperature has been below 35 deg. Fahrenheit.

Part	Minimum number of 24-hour days elapsed after depositing
Posts under beams and girders....	20
Floor slab panels	10
Wall forms	2
Column forms	4
Sides of beams and girders	4
All other parts	10

CINDER CONCRETE

General.—All the requirements of the preceding sections shall apply to cinder concrete as far as consistent.

Storage of Cinders.—Cinders shall be stored on a site which has been cleaned free from vegetable and other foreign materials.

REINFORCED CINDER CONCRETE

General.—All the requirements of the preceding sections shall apply to reinforced cinder concrete as far as consistent.

Size of Cinders.—The largest particles of cinders for reinforced concrete shall pass through a circular hole $\frac{3}{4}$ -in. in diameter in a thin plate, and none shall pass through a circular hole $\frac{1}{8}$ -in. in diameter in a thin plate.

RUBBLE CONCRETE

Soundness of Boulders and Rock.—All boulders and pieces of rock shall be perfectly sound, impervious and durable.

Embedding Rubble.—All boulders and pieces of rock shall be thoroughly cleaned of foreign material, and after being wetted they shall be either floated into the concrete matrix or placed upon a floating bed with full bearing, in which case the concrete, as it is being raised around them, shall be manipulated in a manner similar to that required for exposed faces of walls. The mortar in the concrete shall be made to adhere perfectly to every part of the surface of the boulders and rock.

The report of the Board of Examiners was submitted by Mr. MacKay, who dwelt upon the necessity of maintaining high standards. The matter of appointing a committee to consider general clauses in specifications was brought up by Mr. French, whose motion finally carried after considerable discussion in which Messrs. Johnson, Butler, Francis and Mitchell participated.

Upon the adjournment of the Tuesday morning session, the visiting members were entertained to luncheon by the Montreal members. The occasion was a purely informal one and the speeches complimentary only.

At the resumed session on Tuesday afternoon the report of the Committee on Sewage Disposal was presented by Mr. Willis Chipman, of Toronto. The great importance of this work was emphasized by Mr. Leo-

fred and others and it was decided to retain the committee and give it power to increase its membership.

The report of the Committee on an Improved Engineering Service was submitted by Col. Anderson, who deplored the fact that engineers employed under the Dominion government outside of Ottawa were only placed upon a temporary basis. It was urged that a delegation should go to Ottawa to make proper representations to the government. The committee will continue its work.

Following the reception of the report of the Committee on Steel Bridge Specifications the following gentlemen were appointed a committee on Cast Iron Water Pipes and Specifications:—Messrs. T. C. Irving, Jr., chairman; Newton J. Ker, A. Currie, F. H. Pitcher, C. H. Mitchell, F. Leofred and C. L. Fellowes.

On the whole, satisfactory reports were made by the various branches, which consist of Quebec, Toronto, Kingston, Winnipeg, Calgary, Victoria and Vancouver.

The afternoon session was brought to a close by the presentation of the presidential report of Mr. Phelps Johnson. We reproduce this report in full, as it is devoted entirely to a consideration of the various matters regarding the progress and usefulness of the Society which came in for such extended discussion in these columns after the last annual meeting.

PRESIDENT'S ADDRESS

It is decreed by custom that a retiring President of the Society shall make an address. A good number of my predecessors in the office, following what was probably to them the line of least resistance, have given you a paper on some engineering topic.

I considered following this course, but abandoned the idea for the reason that it seemed impracticable to treat in a satisfactory way a problem in bridge construction without the aid of diagrams and lantern illustrations.

A general review of the progress made in the different fields of engineering, or a review of the more important works that have been carried out in Canada, are both beyond my limitations. I shall, therefore, speak to you only on Society matters, and I am the more ready to do this for the reason that at our last annual meeting and later in published correspondence, complaint was loudly voiced that the Society was not doing enough for its members, and the Officers and Council of the Society did not escape serious criticism.

The objects and purposes of the Society are in its Charter stated to be, "to facilitate the acquirement and interchange of professional knowledge among its members."

It seems evident that this basic purpose of the Society can best be achieved by having enrolled in its membership a large proportion of the able and active engineers of the country, by the interchange of thought and of experience at its meetings and particularly by the reading, discussion and circulation of papers on important and interesting works or investigations.

The Society was organized 26 years ago by a few of the then prominent engineers of Eastern Canada. The movement met with the enthusiastic support of most of the engineers then in active practice, and at the time of the first annual meeting in 1888 there were 225 members and 65 associate members, or a total corporate membership of 290. From that date the number has steadily increased until we have at the present time 622 members and 1,313 associate members, or a corporate membership of 1,935. A few of these members, less than 40 in all, have come in under the Quebec Act, and a few more in this province have joined almost under compul-

sion because of the Act, but the large majority have joined without pressure and without special solicitation, evidently because they considered membership in the Society beneficial and that to belong to it gave them a standing in the profession and in the community that otherwise they would not have.

While the growth of the Society in numbers has been very satisfactory there has been no corresponding growth in the enthusiasm of its members, as evidenced by attendance at the meetings, by the preparation and contribution of papers, or of discussion on the papers submitted, but rather the reverse. The first eight years of the Society's history there was an average corporate membership of 378 and an average of 13 papers per year were submitted, read and published. The last 18 years the average corporate membership has been 921 and the average number of papers per year, again 13. In the first 8 years a paper was presented by one member out of 29. During the last 18 years we have had one paper for each 71 members. During the last 3 years we have had one paper for each 132 members.

Real enthusiasm cannot perhaps be worked up to order, but we can all do our duty, and I would call to your attention that following our election we have all agreed "to promote the objects of the Society so far as in our power," and "to present to the Society an original communication" (meaning a paper) "or some scientific work for the library."

I fear a great many members have so far overlooked this pledge and hope for a great increase in the number of papers in the near future. I would particularly urge that the younger members prepare and submit papers describing the work on which they are engaged, or of which they have good knowledge, and this as much for their own sake as for the good of the Society, for the presentation of a paper of merit will go a long way toward giving them a professional standing they cannot well gain in other ways. A good paper need not necessarily be based on a large and important work, or even a successful one, for failures are often the source of very valuable information.

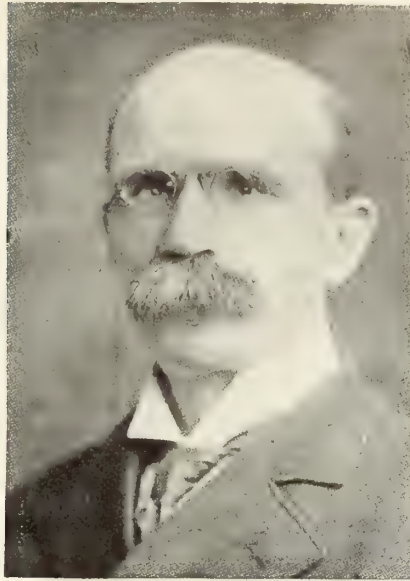
In connection with the complaint that the Society has not been doing enough for its members, it will be interesting to inquire what other societies of similar nature are doing for their members. The societies which at once come to mind for comparison are the Institution of Civil Engineers of Great Britain and the American Society of Civil Engineers. Both of these societies have been long established and have a large membership, both have accumulated valuable properties and have annual surpluses of revenue over ordinary expenditures greater than our entire gross revenue. With ample means at their command and with able management it would seem that we may reasonably expect to find these societies rendering their members every obvious useful service.

The British Institution of Civil Engineers publishes and distributes to its members four volumes per year, each volume containing the reports of the meetings that have been held since the last issue and a list of those admitted as students or as members, or transferred from one class to another. The papers read at the meetings and the oral and written discussions thereon are published, as well as a number of "selected papers" which apparently have not been read and discussed but are considered worthy of publication. A good part of each volume is devoted to "Abstracts of Papers in Scientific Transactions and Periodicals," a typical volume devoting over 100 pages to short reviews of 170 selected articles. The abstracts in the volume examined bear the initials of thirteen different reviewers, and this suggests that the work is not done by the Secretary's staff, but by writers familiar with engineering subjects, specially engaged for the work.

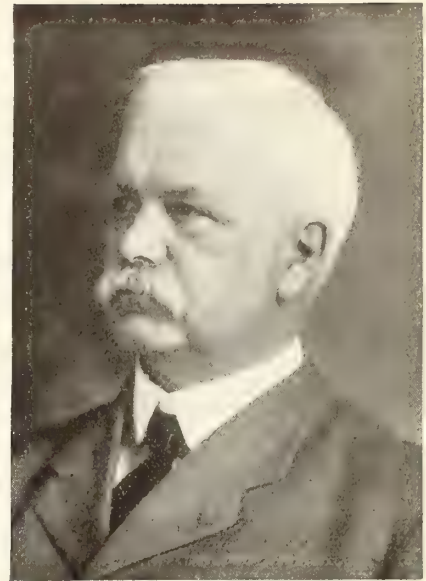
The American Society of Civil Engineers publishes in



Mr. Geo. A. Mountain,
Ottawa.



Mr. C. H. Rust,
Victoria, B.C.



Lt.-Col. Anderson, C.M.G.,
Ottawa.

Three Past-Presidents of the Canadian Society of Civil Engineers who took an interested part in the proceedings of the Montreal Convention.

pamphlet form ten volumes of proceedings per year, each containing brief reports of the meetings of the Society and of the Board of Direction, which corresponds to the Council of this Society, the names of members elected and transferred from one class to another, a list of additions to the library with a synopsis of the contents of the more important books and gives a list of recent engineering articles of interest, reviewing for this purpose more than 100 publications. Each volume also contains a number of original papers with the discussions thereon.

It will be seen that both of these societies not only publish their transactions more frequently than our society, but go to considerable expense in keeping their members advised as to recent engineering literature.

Aside from their activity in this direction I am unable to find that these older and larger societies do their members any service which we are not endeavoring to do for our members, and it is to be borne in mind that these societies are financially able to do for their members every useful service considered desirable.

Neither of these societies has branches or divisions corresponding to our own, though there are a number of local "Associations of Members of the A. S. C. E." in various parts of the United States which hold regular meetings and read and discuss papers as do our branches. These associations have Charters approved by the parent society but receive no financial assistance from it.

Apparently the only useful suggestions we can get from the practice of these two older societies was the desirability of more frequent reports to the membership, and keeping the members advised of current engineering literature, the latter a matter of considerable expense which the finances of the society have not heretofore permitted.

The criticisms made at our meetings and in correspondence have as a rule been very general and with few specific suggestions. There seems to be a feeling that the officers and the Council are not doing all they should, that they are not keeping the members well posted, that the Council is not fairly representative of the different districts, and that it would be well if its members were younger and more enthusiastic and if they served shorter terms.

The remedy for these faults, if they exist, is in the hands of the membership at large, for it can make and alter by-

laws, can designate the Nominating Committee, and can elect Councillors, and through them control the policy of the Society.

Some of the members, I believe a very small proportion, evidently feel strongly that the Society should interest itself in the troubles of its individual members, with the municipalities and corporations employing them, and particularly that the Society should take active steps to keep out so-called alien engineers, and conserve Canadian business for the members of the Society.

I can conceive of no course so sure to discredit and disrupt the Society as to adopt labor union methods, and interfere in the disputes of engineers with their employers.

I agree that Canadian work should as a rule be done by members of this Society, but pressure to this end can best be exerted by the local members and branches, and I feel strongly that except in connection with works handled direct by the Dominion Government, the Society should not officially intervene.

On the whole I consider the complaints that have been made to have little support in existing conditions and believe that the Society has in the past done for its members about all that could reasonably be expected. I do think, however, that the members of the Society have in great measure failed to do for the Society and for themselves all they should and believe they can hereafter, by taking a more active interest in it, by contributing and discussing papers, by attending meetings of the Society and Branches, by paying more attention to the application for membership and advising the Council in regard thereto, and in other ways, make the Society of use to themselves and at the same time promote its interests.

In conclusion I wish to point out one way in which it may be the Society can be of great use to members without engagements or desirous of changing their employment.

The suggestion comes through the Engineering News of the 21st of August last, which, in an article headed "Making Membership in an Engineering Society a Tangible Asset," states that the "Junior Institution of Engineers" in England, a Society of which I have no special knowledge, has undertaken the establishment of a permanent Engineers' Register which will give a complete record of the professional career of every member, the purpose being to form a sort of clear-

ing house to assist members in improving their positions by systematically recording the particulars of their experience and technical training, and by effecting the introductions to engineering employers of members who possess such qualifications as may fit them for vacant positions. To establish and maintain a Register of this nature would involve considerable expense, and would require the hearty co-operation of all members. I think, however, the suggestions well worthy the serious consideration of the incoming Council.

Wednesday morning was set aside for a visit to the works of the St. Lawrence Bridge Company at Rockfield and a good-sized party left the Windsor Hotel on the special cars provided by the Montreal Tramways Company. After an inspection of the works the members were entertained at luncheon by the Bridge Company.

On Thursday afternoon a number of members took advantage of the invitation extended by Mr. S. P. Brown, chief engineer of the Canadian Northern Montreal Tunnel and Terminal Company, and made an inspection of the tunnel. The tunnel work is described in detail in this issue.

Practically the sole topic at the resumed business session on Wednesday afternoon was the relation of the Society to its Branches, the situation arising out of the disposition of the British Columbia branches towards forming a provincial division of the Society in British Columbia. The discussion veered around to all points of the compass and constituted what was practically a re-hash of the correspondence on this subject published in these columns some months ago. The outcome was the approval of a resolution by Mr. J. W. Harkom to the effect that the matter should be referred to a special committee of the council, which will report by November 1 next. The subject came up for discussion again on Thursday morning, when, at a very small gathering of the members, Mr. J. W. Harkom's resolution of the previous day was rescinded in favor of a motion by Mr. Kerry. A standing vote showed thirteen for the amended resolution and eight against. A strong protest was made against the unrepresentative character of such a vote.

A rather prolonged discussion as to means of increasing interest and enthusiasm in the affairs of the Society was fruitless, an aimless series of addresses being brought to a close by a few pointed remarks from Mr. Vaughan, who deplored the waste of time occasioned by the complaints of disgruntled members, urging that these annual conventions should take on a more engineering aspect, instead of developing into nothing but a "family scrap." The business end of the meeting, together with the acceptance of the various branch reports, should be disposed of in three hours, Mr. Vaughan contended, leaving two clear days at the disposal of the members interested in the advancement of things purely professional. Following Mr. Vaughan's observations there was some further argument and eventually a motion in favor of appointing a committee to look into the matter was submitted and lost.

Annual Dinner of the Society

The annual dinner of the Society was held at the Engineers' Club, Montreal, on Wednesday evening, January 28. Mr. H. H. Vaughan presided in the absence of Mr. Phelps Johnson, the retiring president, who was suffering from a severe cold. The place engineers have taken in the building of Canada and the splendid prospects of the profession were the chief topics of the various speakers. The fact that Confederation would

not have been possible without those engineers who had the broad vision, the imagination and the practical ability that brought into being the C. P. R. and the Intercolonial was recalled by Col. Anderson in responding to the toast, "Our Country." Mr. F. L. Wanklyn lamented the ignorance prevailing abroad regarding the great progress that Canada has made and her engineering achievements. He warned those present against wild-cat schemes and urged that all reports should be honest and reliable.

One of the social events of the convention was an enjoyable "Smoker" in the club rooms on the evening of Tuesday, January 27.

The convention came to a close with a session of the council on the afternoon of Thursday, January 29.

The officers elected to serve on the Council of the Society are as follows:—President, Mr. M. J. Butler, C.M.G., Montreal; Vice-President, Mr. R. A. Ross, Montreal.

Councillors: Representing District No. 1, Montreal and district within 25 miles,—Messrs. J. M. R. Fairbairn and H. M. MacKay, Montreal. Representing District No. 2, Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick and the United States—Mr. R. McColl, Halifax. Representing District No. 3, Province of Quebec (outside of the Headquarters district), countries outside of Canada, Newfoundland and the U. S. A.—Mr. A. R. Decary, Quebec. Representing District No. 4, Ottawa and the Province of Ontario east of and including Lindsay—Mr. R. F. Uniacke, Ottawa. Representing District No. 5, the Province of Ontario west of Lindsay—Mr. W. A. Bucke, Toronto. Representing District No. 6, the Provinces of Alberta, Saskatchewan and Manitoba—Mr. F. Lee, Winnipeg. Representing District No. 7, the Province of British Columbia—Mr. G. R. G. Conway, Vancouver.

In a paper before the American Institute of Electrical Engineers, Mr. Charles Fair dealt with the advantages of electric driving for machine tools. Much of the success of a motor-driven machine, he said, depends on its control. There are certain other advantages in the individual drive, but the principal is that it enables the one machine to be controlled to suit the work, with accuracy and with the minimum strain and labor on the part of the machinist and shop laborers. Speaking generally, the individual drive is fitted to costly machines where it is especially important to cut down the time taken in setting up, adjusting, and setting in motion to the minimum.

The large storage dam across the Swift Current river, which will insure a supply of water for a population of over 50,000, has been completed. The dam, which is over 800 feet in length and 25 feet in height, was constructed by the Ambursen Hydraulic Construction Company, of Montreal, under the supervision of Mr. G. K. Mackie, town engineer. Its total cost was \$100,000.

Fireproof wooden shingles are being made in the forest products laboratory of the University of Wisconsin at a cost of \$15 per thousand. The method consists in forcing into the wood, under pressure, such chemicals as ammonia sulphate and ammonia phosphate. It is claimed that the new process is commercially practicable, and extended experimenting is expected to lower the cost.

Clayworkers in Force at the Queen City

The Most Influential and Representative Conference of this Industry ever held in Canada.—Interesting Addresses by President Falconer, of the University of Toronto, and Others — Practical Discussions of Many Trade Topics

THE twelfth annual convention of the Canadian National Clay Products Association opened on Tuesday, January 27, in the King Edward Hotel, Toronto. Nearly two hundred members attended from different parts of Canada, and many other affiliated members from the United States were also present. Mr. Charles A. Millar, president of the association, in opening the convention said there was every evidence of brighter times and greater business ahead, as the present year promised to be one of the brightest in the country's history, not only in the production of brick but also in the manufacture of iron and other products.

Controller J. O. McCarthy, who welcomed the dele-

turers in the near future. Mr. D. A. Lochrie, a past-president of the Association, welcomed the delegates on behalf of the Toronto Clay Products Association.

The president in his report pleaded for a closer bond of union among the brick men of Canada, this with a view to the standardization of the various kinds of brick with regard to price, etc., as in the United States. Referring to the provision for a course of ceramics in the new technical school he announced with gratification that spacious rooms had been assigned to them in order that a full course in this subject would be available.

Mr. John R. Walsh, secretary-treasurer, submitted his report which showed a substantial credit balance and also an increased membership.

The choice of officers for the year 1914 resulted in the following being elected:—President, Mr. Chas. A. Millar, re-elected; Vice-Presidents, Mr. P. H. Stephens, Portage La Prairie, Man.; Mr. J. S. McCannell, Milton; and Mr. J. E. Frid, Hamilton. Messrs. D. A. Lochrie, A. L. McCredie, C. A. Lewis, Angus Germain and Gordon Keith were elected on the executive committee. Messrs. J. S. McCannell and D. O. McKinnon were elected auditors.

There was a very large attendance of delegates at the second day's session of the convention and several papers on various phases of the industry were read.

"Formation and Different Kinds of Clay"

This was the title of a most instructive address delivered by Professor A. P. Coleman, of Toronto University. In an opening reference to the Don Valley deposits, especially the Don Valley brick yard, Professor Coleman stated that there we had a sheet of boulder clay resting on the shale, then stratified deposits formed in a lake, then another sheet of boulder clay above. The boulder clays are glacial deposits, and the beds between are inter-glacial, which showed that there had been a time of warm climate between two ice ages. In the inter-glacial time, there had been a great forest growth in the Don Valley, with trees like those of Pennsylvania or Ohio. Now some of the trees were extinct as also were animals, for instance deer larger than a moose, the buffalo and the mammoth mastodon which lived here.

From the brick-makers' point of view the most important feature was the red brick clay formed in the inter-glacial period. This was the best brick material around Toronto. The ordinary clay around Toronto was boulder clay, which contained too many stones to make good brick material. The glacial lake clays had been deposited under water and were free from stones, but they contained so much lime that they made buff brick. Two or three feet of the surface was generally leached, giving a red brick clay. The whole of the inter-glacial clays were of the leached material giving a fine color of red brick. At Scarborough there are 90 feet of these inter-glacial clays, but unfortunately they are covered by more than two hundred feet of other drift materials, so that they are not available for the brick-man. The clay bank which runs from the Nia-



Mr. Chas. A. Millar, Toronto, re-elected President of the Canadian National Clay Products Association. During Mr. Millar's year of office the Association has made the greatest progress of any corresponding period in its history.

gates on behalf of the city, spoke most optimistically regarding the future of the clay-working industry, stating that reports from the various firms connected with the association throughout Canada showed that they were obliged to take on more employees to meet the orders steadily pouring in, and that many plants which had been closed during the year were again opening with a full list of orders. A couple of months ago many firms had large quantities of brick undisposed of, but now these were all purchased, and the demand was growing. This not only indicated fair conditions in the money market but also great activity in the building trade. Each month he believed the industrial situation would become brighter. This was clearly reflected in the selling of the city bonds.

Mr. J. S. McCannell, of the Milton Pressed Brick Company, responding on behalf of the Association, said they all felt very much relieved by the encouraging remarks made by Controller McCarthy regarding the bright prospects for the clay products manufac-

gara Peninsula, through Milton and Hamilton, and east to the outskirts of Toronto, was one of the best on the continent and practically inexhaustible. Professor Coleman said, in conclusion, that last summer when he conducted a party of geologists from all over the world to the Don Valley brick yard they were immensely interested in the inter-glacial beds. Dr. Horne, of the Scottish Geological Survey, said that it was worth the whole journey from Scotland to have had the opportunity of seeing that section.

The paper was followed by an interesting discussion.

"Ceramic Schools and Their Value" was the subject of a paper contributed by Professor Edward Orten, Jr., Dean of Engineering, Iowa State University, who spoke strongly in favor of every technical institute having a course in ceramics. It was one of the important courses in the Iowa University, and he himself had been connected with the subject for the past twenty-five years. He traced the history of the course in that university and gave a brief account of its growth in popularity in the various schools and colleges in



Mr. J. S. McCannell, Milton, Ont., one of the Association's vice-presidents.

America, concluding by advising the establishment of a course of ceramics and also of test laboratories in the various technical schools throughout the Dominion.

Dr. McKay, L.L.D., Principal of Toronto Technical School, was to have addressed the Convention on the Toronto Course of Ceramics to be started in the Technical School, but was unavoidably prevented through illness from attending.

Mr. Joseph Keele, of the Dominion Geological Survey, read a paper on "Lame Ducks in the Clay Products Business." He ascribed the failure of certain brick plants largely to over-capitalization, mismanagement and going into the manufacture of brick where the clay deposit was not very extensive and petered out. He also showed that had an investigation been made beforehand and some common clay taken and mixed with a portion of good brick clay the manufacture of an excellent brick would have been the result. And besides it could have been made to last a good deal longer.

Types and Construction of Kiln Furnaces

A paper on this subject was prepared by Mr. John F. Wilde, ceramic engineer with the E. H. Crandell

Pressed Brick Company, of Calgary, and read by Mr. Gordon C. Keith. The paper dealt with five different types of furnaces. Additional interest was lent to the article by a number of black-board illustrations which accompanied it. An interesting discussion followed in which Messrs. A. M. Wickers, J. W. Ball and Miller Gibson contributed their views on the question mainly of how much air was necessary for the burning of brick.

The subject of "Brick Yard Kinks" was ably dealt with in a paper read by Mr. A. F. Greaves-Walker, ceramic engineer with the Sun Brick Company, Toronto. Mr. J. E. McElroy, of Dayton, Ohio, contributed a paper on "Burning of Clay Products," and Professor W. H. Day, Ontario Agricultural College, Guelph, spoke on "Tile."

Ceramics in the University

Dr. R. A. Falconer, M.A., president of Toronto University, was present during the morning session on Thursday, and contributed an interesting address dealing with the subject of Ceramics in the University. He said that last year the Clay Products Association waited on him, and this year he thought it only right that he should attend their convention and report on what the Clay Products Association had requested the University to do. He had to report progress but as far as the present finances of the University were concerned they found themselves unable to finance the proposed course. They were in hopes, however, that the Dominion Government would be prevailed upon to extend the work somewhat that they were carrying on at the University at the present time. Already thirty students, most of them final year men, were taking ceramic work at the University and many of the theses of these men would be written on the subject of the manufacture of clay products. At present Mr. Joseph Keele was established at the University doing certain work for the Dominion Government and they had his assistance in arranging the work for those students who wished to make a study of clay products. It was the intention of the government to establish laboratories in Ottawa for the testing of all classes of the material. This, however, would probably take years to establish and they should, therefore, temporarily at least, establish laboratories at certain centres to carry on the local investigations necessary for certain work. Carrying out this idea, laboratories should be established at Toronto University, and as soon as they were able to finance them proper courses in ceramic engineering would be given, these laboratories forming the basis of the course which would be along the same engineering lines as those established for civil, mechanical, electrical, mining and roadway engineering, the last named being closely allied to the clayworking industry. Concluding Dr. Falconer said he was glad to report this progress and asked for the moral support of the clay products manufacturers until they were in a position to bring this course to a successful conclusion.

An interesting discussion followed Dr. Falconer's speech, those taking part including Dean Galbraith, Faculty of Engineering, Toronto University; Professor Ramsay Wright, Mr. Joseph Keele, Dominion Geological Survey. A resolution was unanimously adopted on the motion of Mr. Gordon C. Keith, seconded by Mr. Daniel A. Lochrie, expressing hearty approval of the effect of the establishment of testing laboratories by the United States government, and the announcement from President Falconer that pressure was being brought on the Dominion government to establish such laboratories for the benefit of the clay industries in

Canada. It was decided to circulate the resolution among the members for signature, same to be presented subsequently to the Deputy Minister of Mines.

An important discussion took place regarding the establishment of a testing laboratory in the University, and a resolution was unanimously passed on the motion of Mr. McKinnon, that a committee composed of members of the Executive and others go into the matter without delay.

Fireproofing—Manufacture and Burning

Mr. Miller Gibson, ceramic engineer, National Fireproofing Company, read an instructive paper on "Types of Hollow-Tile Fireproofing—Their Manufacture and Burning." A synopsis of the paper will appear in our next issue.

Friday's Session

The convention closed on Friday afternoon with a series of interesting papers followed by the installation of officers for 1914. The history of the Clay Products Association was reviewed by Mr. D. O. McKinnon. Mr. M. E. Gregory, president of the Brick, Terra Cotta and Tile Company, Corning, N.Y., discussed "The Commercial Side of the Clay Business," and a pa-



Mr. John R. Walsh, Toronto, Secretary of the Canadian National Clay Products Association.

per on "The Making and Burning of Tile" was contributed by Mr. W. H. Moodie, Highgate, Ont. "The Possibility in the Advertising of Clay Products" was the subject of a paper by Mr. A. L. McCredie, Toronto, and a resolution was passed advocating the advertising of brick. Mr. M. B. Cheney, ceramic engineer with Shale Products, Limited, Inglewood, also read a paper. A feature of the proceedings was an address on "Advertising," by Mr. H. N. Casson, New York. Mr. Casson also addressed a large audience at a luncheon in McConkey's Restaurant, under the auspices of the Convention.

The public accounts of the province of British Columbia for the fiscal year ending March 31, 1913, show that the sum of \$4,790,461 was spent on roads, streets, bridges and wharves, and \$2,815,648 on works and buildings, which means an expenditure of about \$5,000,000 in public works.

The Architect and His Relation to the Housing Problem

BEFORE a recent meeting of the Vancouver Branch of the British Columbia Society of Architects, Mr. H. H. Stevens, M.P., read an instructive paper on "The Architect and His Relation to the Housing Problem." After an opening reference to architecture as one of the most ancient of arts, and the architect in his early history simply a master-builder, Mr. Stevens discussed the powerful influence of ancient architecture upon the national life. Egypt he referred to as the most ancient example of architecture, dating as far back as 5,000 B.C., and to which we were largely, if not solely, indebted for the history of that wonderful civilization. Contemporaneous with the latter period was that of Syria and Mesopotamia, then followed the Persian and Syrian age about 500 B. C. to 350 B. C. Then commenced the era of Grecian art remarkable for its grace, beauty and wealth of detail, and which so deeply affected the life of the whole Roman empire. The two great orders of Grecian art, the Doric and the Corinthian, formed the roots of all subsequent types of European architecture.

The introduction of Grecian architecture into other parts of Europe greatly developed the Romanesque style, which in turn brought forth the Gothic, reaching the culmination of its perfection in the thirteenth century rivalling in beauty the art of ancient Greece. Mr. Stevens next described the Mohammedan type which followed in the main the earlier Byzantine style in Northern Africa, Asia Minor, India and Europe. The architect should combine artistic perception, technical knowledge and business training, and these qualifications should take precedence in the order mentioned, but none of them should be omitted from the acquirements of the competent architect. He required the artistic perception to conceive the design, the technical knowledge to reduce the confidence of his principals so that he might be the director of operations rather than a mere hireling. In the larger sphere of national undertakings the architect should become the recorder of the nation's history in the types of building produced after the manner of the ancients, combining present use with lasting qualities.

Discussing the subject with relation to the housing problem he suggested that the architect should also be a sanitary expert, at least that he should understand the principles of sanitation, for the first duty of the public man and of all responsible citizens was properly to conserve the health and social conditions of the people. In the course of a detailed reference to the design of buildings in western cities, Mr. Stevens referred to New York as affording a striking example between the old-fashioned dumb-bell tenement and modern apartments with each room accessible to fresh air. Summing up his remarks he said:—"Your art is as old as civilization. It has been the medium from which past stores of valuable knowledge have been prepared for mankind. In all ages it has a marked effect upon the race, moulding national life and elevating thought and ambition. It is an honorable and inspiring profession worthy of a man's best effort. You may stamp for all time your personality upon the great public buildings of our land, and you may also engrave your name on the more obscure but none the less lasting life of the people by giving the poor of the congested centres health and happiness in the buildings you design for their habitation."

The Mount Royal Tunnel Entry into Montreal for the C. N. R.

THE Canadian Northern Railway now has under contract about 2,500 miles of railroad, which when finished will complete its Transcontinental System, with a total mileage of over 10,000. The greater part of this mileage is in the grain fields of the middle West, where that great mass of traffic originates which has made Montreal the second busiest harbor on the American continent. It is largely this enormous grain traffic, amounting often to over 1,000,000 bushels of wheat alone per day, that has enabled the Canadian Northern to pay the interest on its bonds, invariably, the first year of operation, on every line opened in the West. In regard to economy of operation it is also interesting to note that the Canadian Northern Transcontinental line not only has the flattest grades but also the lowest summit of any line crossing the Rocky Mountains. When this line is completed in 1914 it will be the second transcontinental system to be operated in Canada. With this immediate completion in view it became imperative to develop such terminal facilities in Montreal (see Figure 1) that this new artery should never become congested and that the ever-increasing traffic should be encouraged to the fullest extent. In this the forehanded policy of the Montreal Harbor Commissioners and the progressive character of their Chief Engineer, was a great incentive, their plans anticipating extensions and improvements with which the Canadian Northern was most heartily in accord.

Montreal now has a population approaching 800,000, which is increasing at the rate of nearly 10 per cent. per annum. Of this population nearly 75 per cent. is of French extraction. The city is divided into two principal levels—the commercial and financial quarter being on a plain only a few feet above high water, and the residential and shopping district, being on a plateau about 75 feet above the river. In general, the French live to the East and North, while the English-speaking population live in the southwesterly part of the city and on the higher slopes of Mount Royal. As the space between Mount Royal and the St. Lawrence river is very limited, this district has become very congested. Business has largely forced the residence section up and down the river and around the Mountain. An entry from either end of the narrow strip would have been very difficult and expensive in many ways, and, as the Canadian Pacific Railway and Grand Trunk Railway already had lines entering in this manner, no advantage could thus be gained. On the other hand, by tunneling straight through Mount Royal (see Figure 2), the Passenger Terminal could be located in the very centre of the most desirable section, midway between the two levels, and equally convenient to the English and French parts of the city. Furthermore, in the same direct line and without change of grade, the tracks could be carried from the Passenger Terminals across the lower town on an elevated viaduct to connect with the Harbor Commissioners' proposed viaduct; thus giving direct access to the Canadian Northern Transatlantic Steamships, all ordinary harbor facilities and a possible bridge across the St. Lawrence river. Connected with this viaduct an elevated Freight Terminal is planned in the centre of the commercial district, for the acceptance and delivery of local freight.

The Passenger Terminal is located between Cathcart and Lagauchetiere, St. Monique and Mansfield Streets. Its platforms, which are about 1,200 feet long, will be 45 feet below the upper level at Dorchester Street, and 20 feet above the general lower level of the town. Its entrances will be so arranged above and below as to automatically segregate the express from the commuter traffic.

The Terminal buildings (see Figure 3) will be, architecturally, one of the most attractive groups of a commercial nature in Canada. They will, however, be of a purely utilitarian character. It is expected that, apart from the railway business, the income from these buildings alone, will go far towards making the Terminal developments self-supporting.

Much credit for both the conception and realization of this most ingenious entry is due to H. K. Wicksteed, Chief Engineer of Surveys for Mackenzie, Mann & Company, Limited, who, with the principals, conceived the plan in its entirety.

Mount Royal, "The Model City."—Back of the mountains, on the lower slopes, a large tract of farm land was bought, extending northwesterly

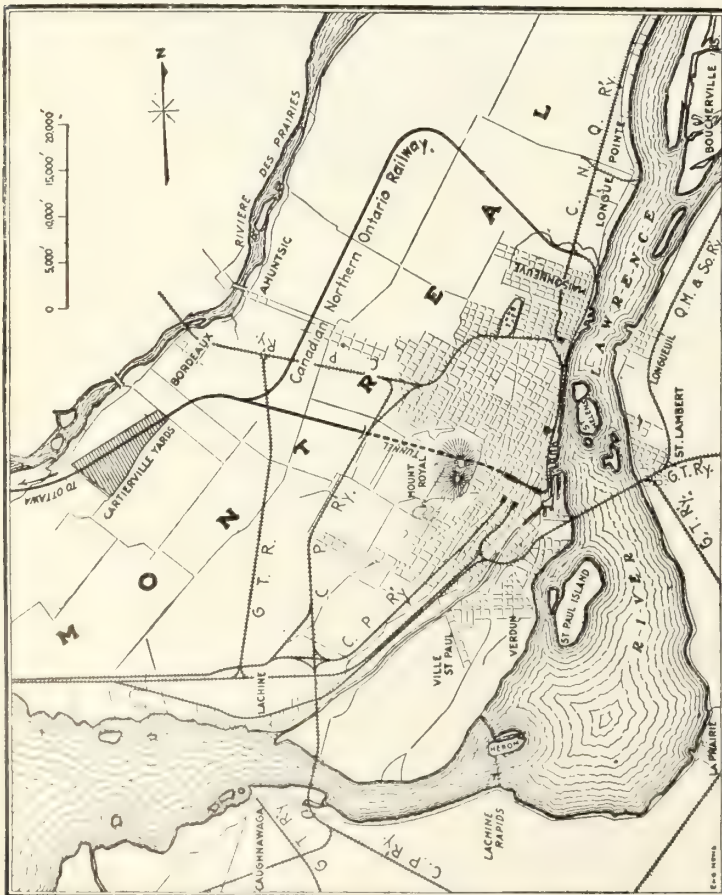


Figure 1.—General plan of terminal connections, Montreal.

to the Back, or Ottawa river. Mount Royal, as incorporated, is about one and a half miles in width by two miles, and has not a gully, hill, ravine, nor any low, wet land in the whole town site. The entire property slopes towards the Back river, with an average drop of thirty-five feet to the mile. This Piedmont country was the land so famous for its Montreal melons. It is very fertile and was the most prosperous farming section about Montreal. Its natural drainage lends itself peculiarly to modern municipal sanitation and the geological structures, consisting of solid hard pan only a few feet below the surface, will be invaluable for cheap and easy building foundations. This point is particularly appreciated by people in Montreal who are familiar with the soft and shifting leda clay so common to the city side of the mountain.

Departing from the usual arrangement of having all cross streets run at right angles, the plan provides for diagonal business streets which converge to the central station. This will permit easy and rapid access to the trains from any point. As all public utilities, such as water, sewerage, electric wires, etc., are restricted, where possible, to the alleys, which run

large parks have been provided. All residential lots are fifty feet wide and vary from ninety-five to one hundred and ten feet in depth. The business lots will average thirty-three by one hundred and twenty feet. A local station called "Mount Royal Heights" will be built where the Canadian Northern line crosses under the Canadian Pacific Railway's belt line, at the west portal of the tunnel. There will be entrances to the station on the Model City side of the C. P. R. The main station, however, back of the mountain will be in the centre of the town of Mount Royal.

Geological Conditions of the Tunnel

Mount Royal, about 700 feet high, is the result of a volcanic intrusion of igneous rock forced upward through the original bed of Trenton limestone. Whether it was ever an active volcano is doubtful, as there is little evidence of lava, although it may have been scoured away by glacial, or other action, at the same time that the higher portions of the mountain were similarly eroded. There have evidently been several stages of eruption or intrusion, as both the limestone and main igneous body of so-called Essexite are

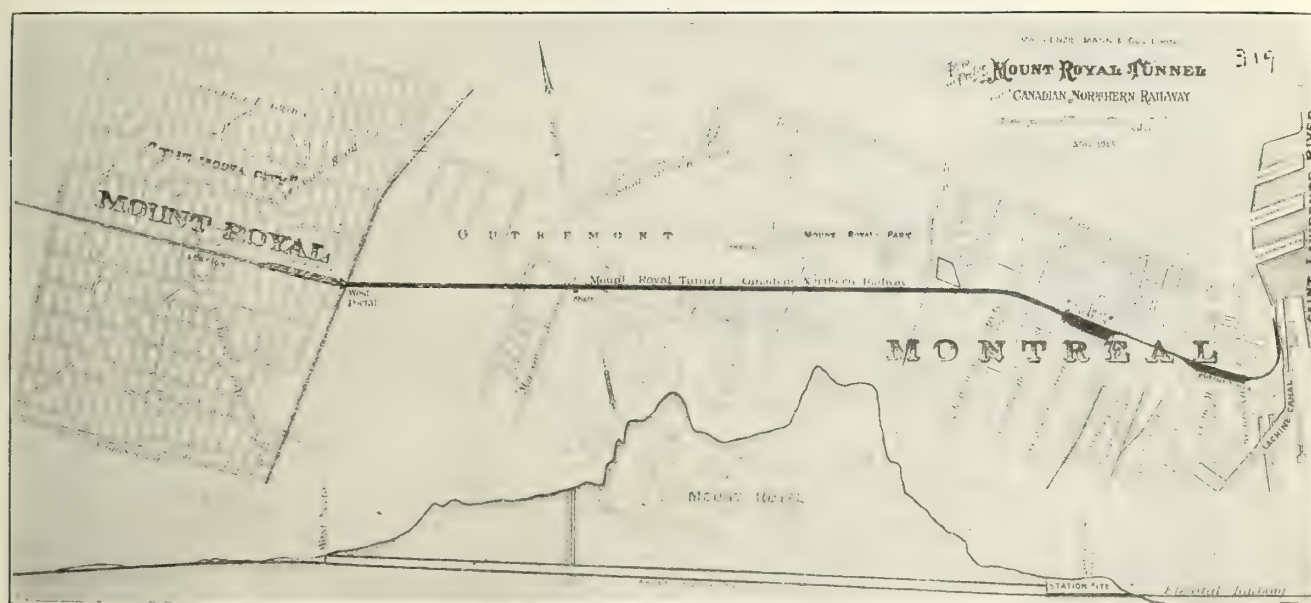


Figure 2.—Plan and profile of Mount Royal Tunnel.

through the centres of all blocks, the street pavements will not be continuously broken up and under repair from this source as is so common in the usual city street.

Four streets have been reserved for business purposes, namely:—Graham road, Laird avenue, Canora avenue, and Rockland avenue. These are the only streets where it is possible to erect solid rows of buildings, and it is only on these streets that permits may be obtained for flats and apartments. The balance of Mount Royal will be restricted to high-class residential buildings. Each residence must be at least two storeys in height, built of stone, brick or cement, on stone, brick or cement foundations, at least fifteen feet from the street line; any out-buildings must be at least seventy feet from the street line. Only detached or semi-detached residences will be permitted. Proper restrictions regulating the cost of buildings will also tend to keep the standard high. Each residential street is sixty-six feet wide, and the diagonal business streets are eighty feet in width. The boulevard, which is sixty-six feet in width, encircles the property, and thirteen

broken and cut by a multitude of dikes and sheets of quite different character and evidently later origin. The Trenton limestone, at a considerable depth, is found to be hard and crystalline, and is an excellent rock for tunneling. This rock, when in close proximity to a large igneous body, is sometimes highly impregnated with epidote, quartz, garnet, and other minerals.

At the city end, going west from Dorchester street, the heading for the first 2,000 feet is in a soft black limestone, somewhat blocky and in places partially disintegrated, with occasional stretches of earth roof. The earth, above the limestone, consists of sandy clay, boulder clay, occasional layers of hard pan, fine sand and large bodies of blue leda clay. This being under the city proper, forms the most difficult ground and conditions to be encountered, and a roof shield will be used.

As the rock cover increases the rock becomes harder and more dikes of extremely hard igneous rock, principally Bostonite, Camptonite and Nepheline Syenite are encountered. By the time 3,000 feet of

heading had been driven, from Dorchester street, the heading (except for the dikes) was in good, sound Trenton limestone, becoming more crystalline. It was in this that the record progress mentioned later was made.

The Essexite is very hard, containing Plagioclase Felspar, Pyroxene, Hornblend, Magnetite and Nepheline. Aside from this it is a good tunneling rock.

The greatest difficulty encountered in drilling and excavating is due to the irregularity of the structure. Some of the limestone is so impregnated with various contact minerals that it is extremely hard to drill and some breccia is so broken and uneven that in places one hole would be lost out of three started. The worst trouble, however, occurred when large dykes were encountered which necessitated entirely changing the temper of the steel used; for instance, in the heading going east from the westportal a dyke or porphyritic Camptonite, an extremely hard rock, four feet thick, continued in the face for 400 feet. Here two tempers

nailhead pattern. Here too, is found a good deal of saponite and pyrites in various forms. Considerable Dawsonite, Feldspar, metallic arsenic and gypsum have been found from time to time, but not in quantities to be commercially valuable.

Tunnel Location

The location of the tunnel under Mount Royal was established more or less by the location of the passenger terminal in Montreal and the "Model City" at the back of the mountain. For many reasons, a tangent from the central station in the "Model City" to the passenger terminal in Montreal would have been most desirable. But as this would have necessitated passing under much valuable property with very light cover, it was thought best to abandon it. This line would also have passed through a large body of Nepheline Syenite, which is a very hard rock.

It was known that the heart of the mountain was a hard igneous Essexite, as above described, and that

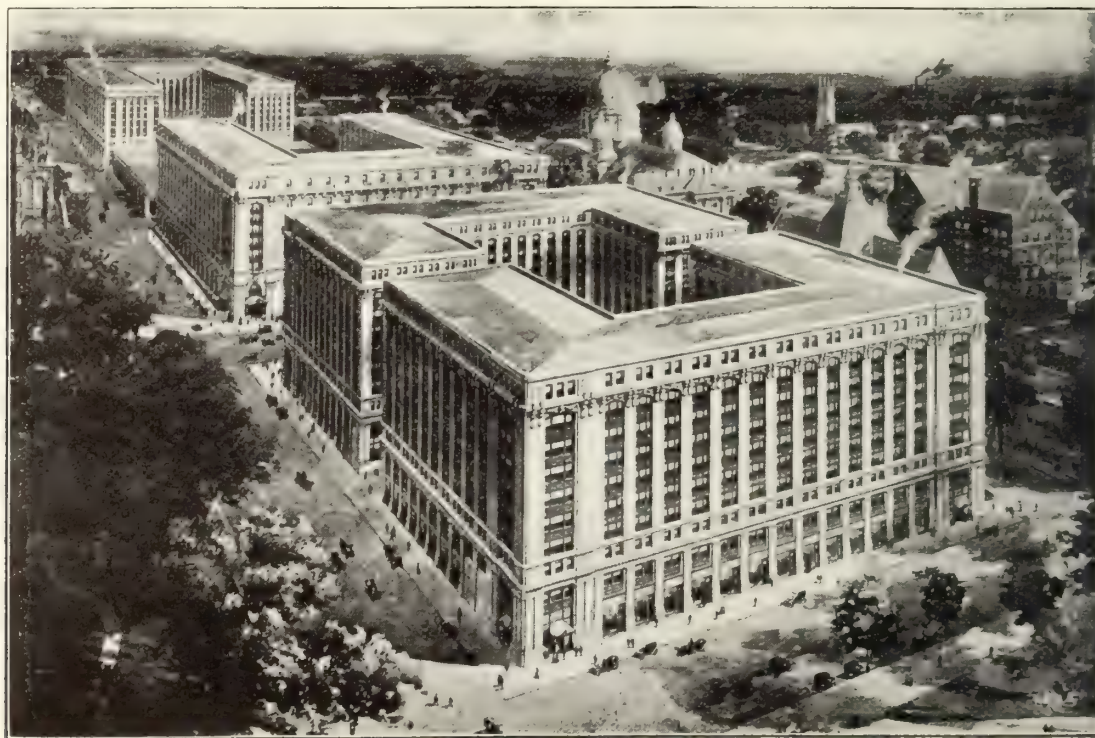


Figure 3.—Proposed buildings for Canadian Northern Passenger Terminal. Messrs. Warren & Wetmore, architects.

of steel were required in the heading all the time. This greatly retarded the progress and materially increased the cost of excavation.

Another very difficult rock is a marmorized limestone that was found in heading No. 1-W. This marble is impregnated with quartz and a natural cementing material that makes it hard to drill and causes the muck to set up so rapidly that it is very difficult to shovel into the cars.

In general, the Trenton limestone is an excellent tunneling rock although the roof is sometimes inclined to scale badly and where this ground is cut by dykes the tunnel walls are apt to be insecure. When this limestone is badly distorted by neighboring igneous intrusions it is apt to be filled with internal strains which cause it to crack and fall making it rather treacherous and requiring heavy timbering and masonry lining.

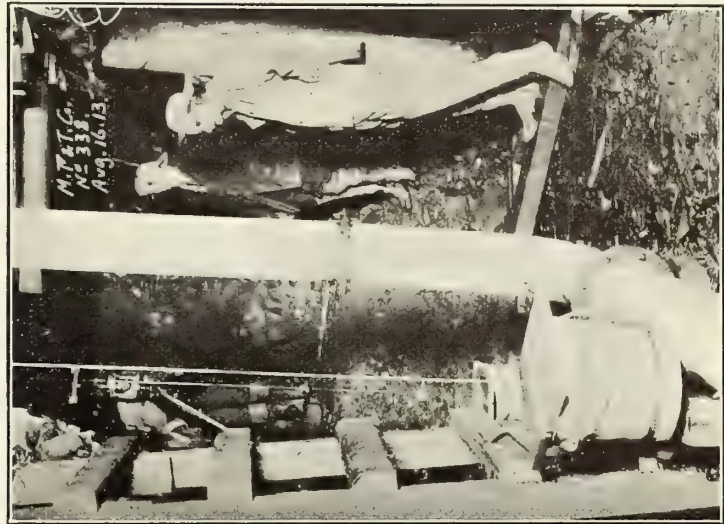
Often, especially in the limestone, cavities are found filled with calcite crystals of both the dogtooth and

Camptonite breccia outcropped near the west portal. While this lower ridge of breccia and hard rock could not have been avoided without seriously affecting the layout of the "Model City," a portion of the hard rock in the centre of the mountain could have been avoided had it been considered expedient. The line finally adopted is 3 1-10 miles long and is the shortest line possible between the two main objective points, that could be devised to avoid surface obstructions and take advantage of the geological formation. This gives, economically, an extremely good tunnel line, which (with the exception of one curve under the McGill University grounds) is all on a tangent and has only sufficient grade (0.6 per cent. down toward the city) to insure proper drainage.

Surveys and Alignment.—Tunnel surveying is interesting, principally on account of the accuracy required and the many opportunities for the exercise of ingenuity. It consists primarily of definitely locating and mapping all the topographic features in the imme-



A—Measuring.



B—Shaft plumbing.

Figure 5.—ALIGNMENT SURVEYS.



A—Igneous dykes in Trenton limestone. After the Mountain had been shattered by an eruption, this trap flowed into the cracks forming the dykes.



B—Camptonite Breccia. The black rock in this conglomerate is Camptonite Trap which has flowed about the shattered limestone marmorizing it by the terrific heat, the white rock being marble.

diate vicinity of the proposed line. Upon the maps thus prepared, the best positions for the openings such as shafts and portals can be fixed upon, the best underground route for the tunnel laid down, and the design of its construction determined.

The alignment parties give the direction for excavation and all points for placing the construction. In order to get the true direction and distance from one opening to another it is necessary to have their position on the ground accurately determined. This requires careful measurement and angle reading. As the work progresses the calculated courses and distances between the shafts or portals are placed in the openings and the direction in which to excavate shown to the rock drillers. Careful steel tape measurement is

After the places of entry had thus been located, and lines in the vertical planes of the tunnel axes had been established, points were fixed from which sights could be projected directly into the tunnel. The lines were projected down the shafts by means of heavy plumb-bobs suspended on fine piano wire. These wires were lined up at the top of the shafts from the fixed points on the surface line and at the bottom the direction was taken off the wires and projected into the tunnel. The plumbs were suspended in tubs of water and oil to retard oscillation. In the present case this work was somewhat more complicated than it sometimes is, on account of the necessity of locating the shafts on the company's property, which was not directly over the tunnel. This made some sharp

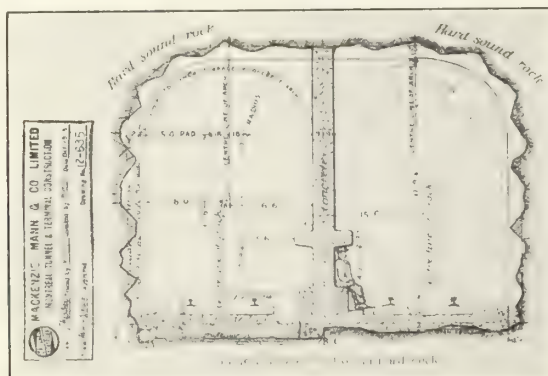


Fig. 6.—Tunnel cross section in hard sound rock requiring no lining.

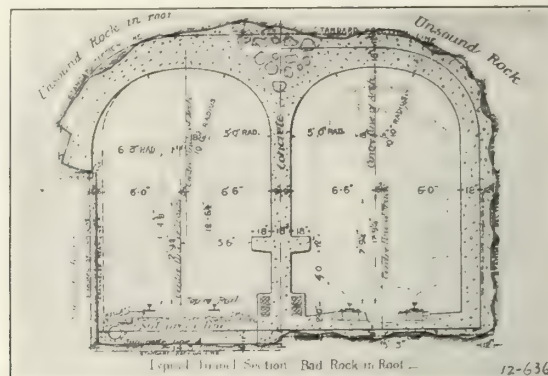


Figure 7.—Typical tunnel section, bad rock in roof.

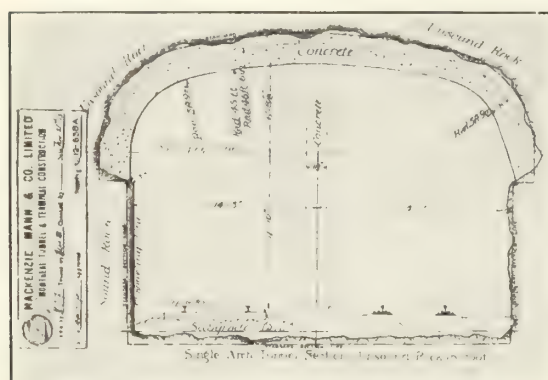


Figure 8.—Single arch tunnel section, unsound rock in roof.

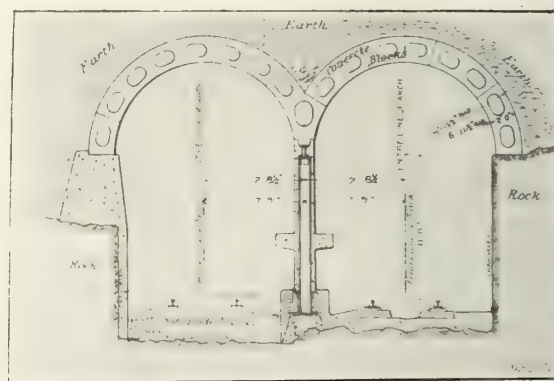


Figure 9.—Tunnel cross section in very soft ground, requiring shield, concrete block lining.

often called base-line measurement, as many base lines for triangulation work are determined with the same methods. The careful measurement was made in this case along the paved streets on the north side of Mount Royal. On this work the steel tapes used were compared with a special tape standardized at the Bureau of Standards in Washington, D.C., at a given tension and temperature. In the surveys the readings were always taken at the standard tension and corrections made for temperature. The tapes were stretched across movable brass headed monuments, called spiders, set upon transit lines. The levels of the spiders were taken to correct for inclination. The standard tension in the tape was maintained by a standard weight suspended over an inverted bicycle wheel (see Figure 5). The tape was supported every 20 feet, which was also standard. After the traverses had been completed a transit line was thrown over the mountain on the tunnel tangent line as a check with very satisfactory results.

curves and short sights in the headings at the foot of the shafts to get to the tunnel line.

Heading on Centre Line of Main Tunnel

The primary excavation consists of a heading, or small tunnel, about 9 feet in height by 12 feet wide, driven on the centre line of the main tunnel, which is about 22 feet high by 30 feet wide. As this is a bottom heading, i.e., driven along the sub-grade of the tunnel proper, the permanent monuments are placed in the bottom of the heading, where they will not have to be disturbed. Only temporary wooden plugs with steel spads, i.e., nails with perforated heads to suspend sighting lamps on, with occasional brass vernier scales are placed in the roof. The plugs with spads are placed about every 50 feet in the heading on the engineer's line, and by knowing the relation of this line to the tunnel centre-line, and the various elevations of the spads, the alignment and grade of the heading may be maintained with considerable accuracy.

In all tunnel surveying, patience and continuous repetition is the key to success. All lines must be checked and re-checked, and readings made again and again by the independent observers, so as to rectify errors and produce the greatest accuracy possible. This is especially important in the underground work where no outside check can be obtained until the headings meet.

The methods just described have worked out very satisfactorily in the present case. The Maplewood avenue shaft is one mile from the west portal. The shaft is about 240 feet deep, and the plumbing wires were only 13 feet apart. The shaft is off line and requires short reverse curves in transferring the lines from the shaft to the tunnel. When the heading coming from the west portal met that being driven from the Maplewood avenue shaft, on April 5, 1913, the lines checked within 1-16 inch in alignment and $\frac{1}{4}$ inch in grade. Where the headings between the Maplewood avenue shaft and Dorchester street shaft met, under the highest point of Mount Royal, on December 10, 1913, the error was about three-quarters inch in line and one-quarter inch in grade.

Tunnel Cross-Sections

The types of tunnel cross-section finally adopted, while bearing many points of similarity to various other tunnels already in existence, have a few novel features that are believed to be a step in advance in that particular branch of railway engineering. In the studies for this design, the maximum equipment of American roads was summarized, and actual clearance and equipment diagrams of many of the most representative roads were studied and superimposed. In this manner a diagram of minimum clearance and a diagram for maximum equipment were evolved, for all cars likely to pass through the tunnel. It was found that a few freak cars, of exceptional width, had to be eliminated, but these were very few, of a class not likely ever to appear, and which had not been allowed for on other important roads.

A twin section was chosen for three primary reasons: (1) economy in construction; (2) ease and economy in ventilation; (3) protection and safety in case of derailment or accident.

1. Economy in Construction.—It was found that in soft ground the amount of both excavation and masonry could be reduced by adopting this twin section. The geological formation also indicates that in much of the rock, cut at the angle made by the present tunnel location, a centre wall will sufficiently reinforce the natural rock roof slab to eliminate the necessity of further lining without excavating a high rock arch.

2. Ventilation.—It is needless to say that a twin tunnel with all the traffic in each tube going in the same direction, is infinitely better for ventilation than a double track tunnel, where passing trains merely tend to stir up the air, without causing any positive and continuous movement in any one direction. The cross-section of each tube is so proportioned that the relation of train area to tube area will materially encourage ventilation without producing excessive compression, which would retard the velocity of trains and might be objectionable to passengers.

3. Safety.—The centre wall is particularly valuable in case of derailment or accident, there being no possibility of trouble on one track

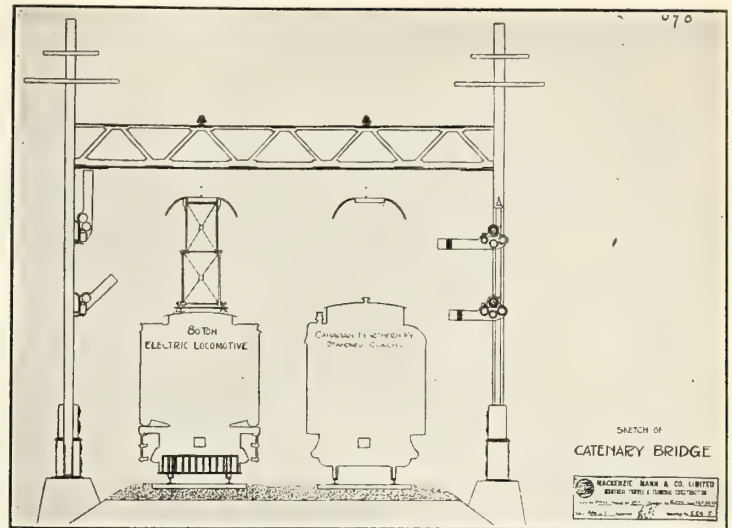


Figure 10.—Outside bridge construction for contact circuit.

blocking both. Furthermore, having a walkway at about the platform level, it is possible for passengers to get out of the cars, in natural and orderly fashion, in case of stoppage and walk to the nearest cross passage, where they can enter the adjoining tube. This walkway is made narrow so that people must pass along in single file, the idea being to avoid the danger of crushing and panic.

The normal clearance at the walkway edge is 2 in. greater than that of the normal high passenger platform adopted in the terminal station, and 3 in. greater than that allowed on the New York Central R. R. and Pennsylvania R. R. lines about New York. The walkway edge also coincides with the clearance lines (outside of platform) of the Pennsylvania R. R. (lines east of Pittsburgh), including the through lines between New York and Pittsburgh.

Underneath the walkway is a continuous refuge niche, except at splicing chambers, where trackmen may sit on the duct bench, at the bottom of the dividing wall, and be absolutely protected from passing trains. Large refuge niches will be built occasionally in the outside wall for the accommodation of hand cars and repair equipment during hours of train operation. The outside wall clearance is coincident with the clearance for new structures in the New York Central R. R. terminal work in New York, and is in excess of the clearance of the Pennsylvania R. R. lines east of Pittsburgh.

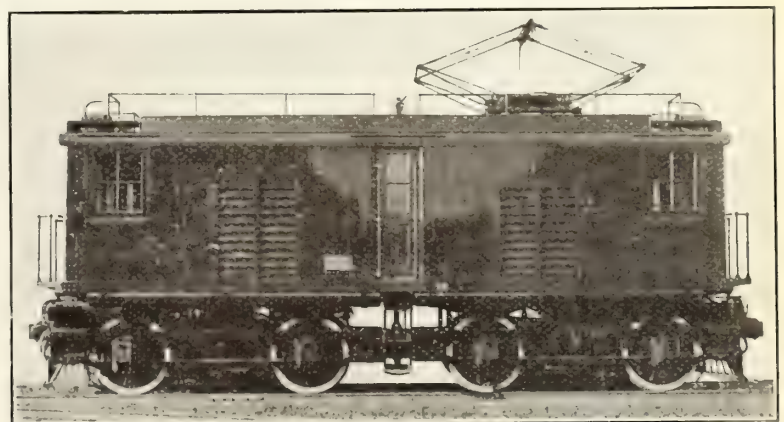


Figure 11.—80-ton, 2,400-volts, direct current, electric locomotive, to be used on Montreal electrification.

A high headroom was adopted as provision for a high-voltage trolley. The flattened three-centre arch was adopted: (1) to allow for the sway of the pantograph; and (2) on account of the stratification of the rock, where much of the lining will occur, which lends itself peculiarly to a flat roof (see Figures 6 and 7). In the soft ground on the city end, where a roof shield is to be used, twin semi-circular arches will be used slightly higher and wider than the standard section. This change in shape and size was adopted on account of ease and safety in construction. (See Figure 9.)

The floor and track construction will be of two types: (1) creosoted ties, with tie-plates and screw spikes, laid in a deep trough of ballast; (2) a fixed grade and alignment, produced by rail supports rigidly fastened to a concrete bed. The former, used under the city proper, is designed to produce the least possible vibration. The latter type being for stations, and in the major part of the tunnel, is designed for

The locomotives are 80 ton (see Figure 11) and capable of producing a speed of 50 miles an hour. The heaviest trains will be 16 car Transcontinentals, the rated speed being 30 miles with two locomotives. The Multiple unit cars are 60 ton cars with a speed of 45. These cars can also haul one trailer if desired. All steel cars will be used.

miles per hour and a seating capacity of 70 passengers.

The power used will be 2,400 volts direct current. All motors are wound for 1,200 volts and insulated for 2,400 volts, and are operated two in permanent series. The contact circuit will be of the overhead catenary type, the character of the climate making a third rail inadvisable outside the tunnel. (See Figure 9.) A sub-station for power conversion will be built near the west portal of the tunnel. If the company develops its own power, or buys its power, where there is doubt of continuous service a steam auxiliary plant will be built near the Back river. Near the Back river, too, will be

the Cartierville Yards where most of the freight will be sorted and the transfer made from steam to electric traction. Here also complete repair shops will be erected. The signals will be of the automatic block type with a special safety device by which a train is automatically brought to a stop if the engineer inadvertently runs by a block signal that is set against him.

On the Multiple unit cars special safety appliances are arranged so that if the motor man collapses for any reason, the train is brought automatically to a stop, and by certain door connections no train can start until all doors are closed.

Excavation and Construction

There are many methods of tunneling, usually known by the name of the country in which they originated or have been most commonly applied. The so-called American method is the top heading and bench method, where a small tunnel or heading is driven in the up-

per half of the tunnel section and the bottom portion or bench is removed later, often with a steam shovel, where the character of the ground permits. This is often very economical and has many points of advantage over other methods where the ground makes it advisable, but it is not as fast as some of the European methods, which have been developed for long tunnels where time was of very great importance.

Time being of vital importance in the Mount Royal Tunnel it was decided to adopt a bottom centre heading which could be driven ahead rapidly, without much regard for the character of the ground, and from which the full-sized excavation could be developed at as many places simultaneously as desired.

Heading Excavation.—The headings are driven 8 to 10 feet high by 12 to 14 feet wide (over 50 per cent. larger than the headings of the principal Alpine tunnels) for the sake of ultimate economy. While this somewhat reduces the rate of progress, it very much decreases the cost of further excavation and construc-

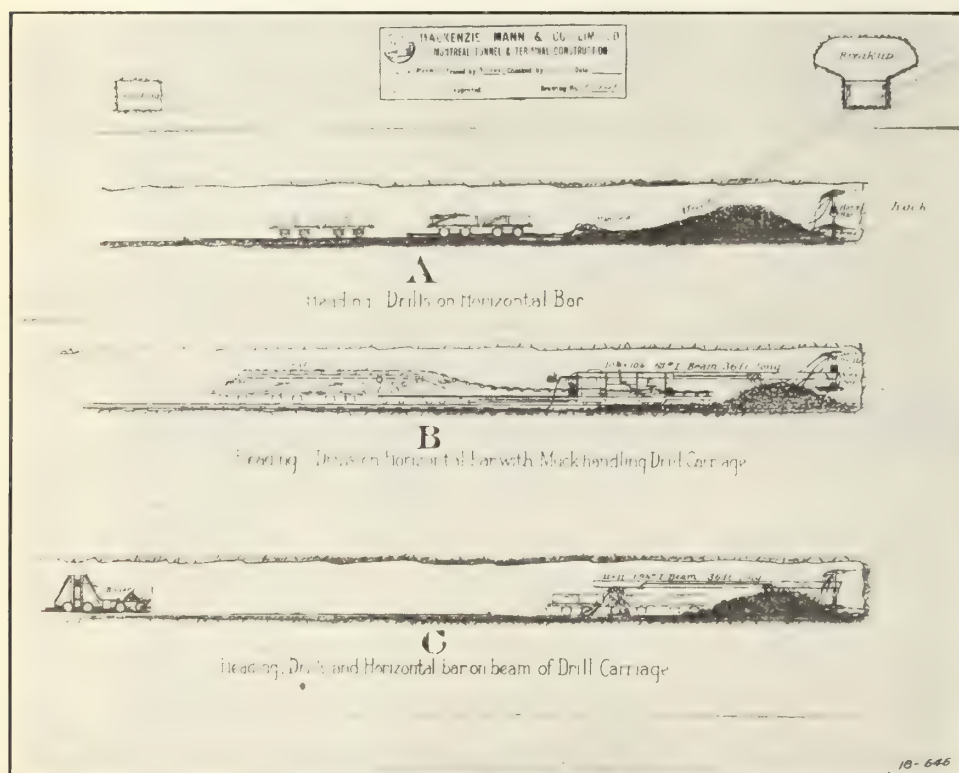


Figure 12.—Typical heading procedure.

small maintenance cost with perfect grade and alignment.

The general cross-section, as above described, will vary materially, in certain details, with the character of the ground through which the tunnel passes. Where the roof is bad, and the sides are in good rock, the side-wall concrete may be omitted, where the rock caves in the roof a double track arch may be used (see Figure 8). As the work is being done by Mackenzie, Mann & Company, Limited, who control the Canadian Northern, with one organization for both design and construction, every flexibility in design may be taken advantage of for economy in construction.

Electrification

All trains through the tunnel will be operated electrically. Locomotives will be used to haul Transcontinental, Express and Local traffic, which extends beyond the "Electric Zone," and multiple unit motor cars will be used for the traffic inside the boundary.



Figure 13.—Heading excavation without drill carriage.

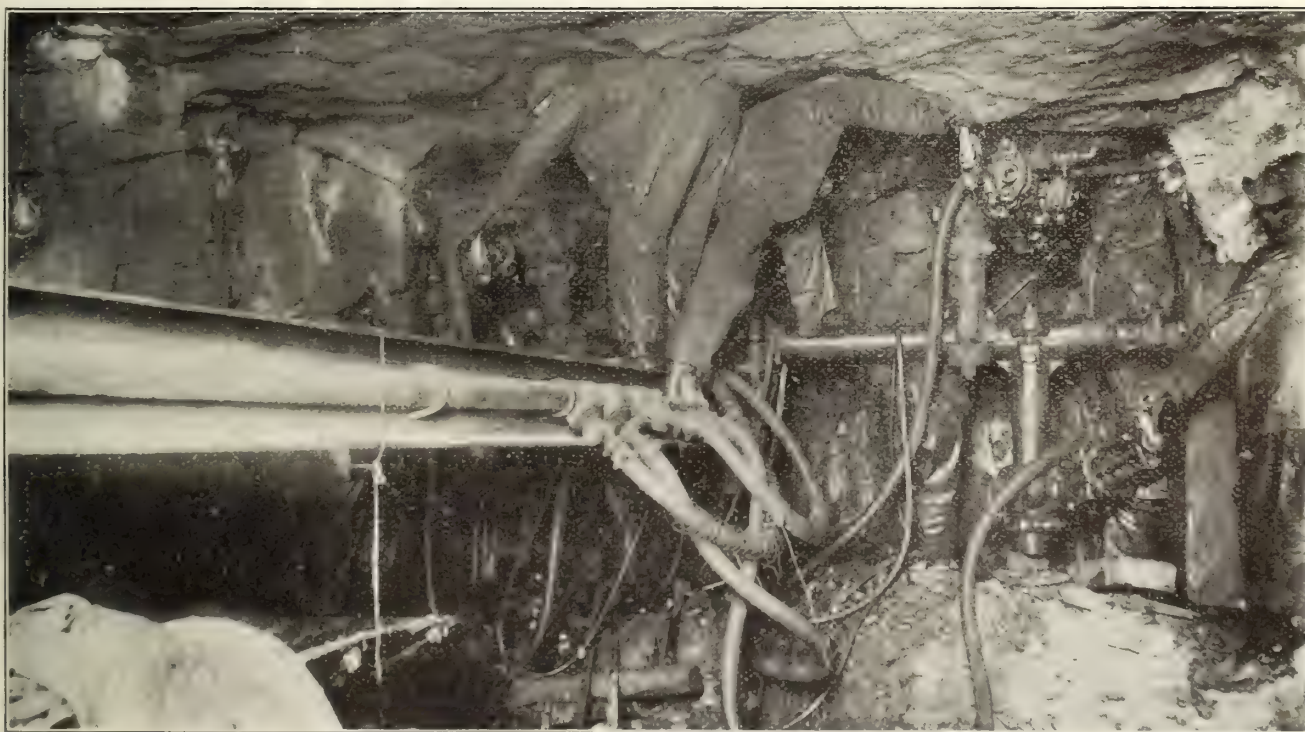


Figure 14.—Heading excavation using muck handling drill carriage.



Figure 15.—Heading excavation using drill carriage without conveyor.

tion; permitting reasonably broad-gauge double track through the break-ups, where the full size tunnel section, 22 feet high by 30 feet wide, is developed.

In the headings three principal methods have been used (see Figure 11). "A" Figure 12 shows the method where the rock was not so hard as to require an excessively heavy drilling equipment. The drills are mounted on a horizontal bar and the equipment is handled in and out of the heading by hand. During this stage at the city end the heading cross-section was reduced to about 8 by 12 feet for the sake of rapidity in progress. (See Figure 13.) Here no drill carriage was used, as much lighter drills were required, and a progress of 810 feet was made in the 31 working days following May 1. This is the greatest linear progress ever made in a hard rock heading on this continent and has only been exceeded in Switzerland. Four drills are used in each heading, supported on a horizontal bar. These drills are operated by compressed air at about 100 lbs. pressure per square inch. Each drill is fitted with special connection so that water may be forced through the piston and drill steel, which are hollow, into the bottom of the hole being drilled, thus keeping it cool and clean. It is also interesting because both the linear feet of drill-

ing (about 650 feet per 24 hours) and cubic yards of excavation (93 cubic yards per day) exceed anything ever accomplished in the European tunnels.

As the headings got into the hard igneous rock heavier drills were required, so that the total drilling equipment, including drills, saddles, arms and bar, weighed several tons. To carry this mass two types of drill carriages were devised (see Figure 12). Each carries the drill bar on a long cantilever arm having a reach of over 20 feet beyond the carriage and is so arranged that the drills never have to be dismounted from the bar nor disconnected from the hose-manifold which is fastened to this cantilever arm. Thus the only connections to be made, when moving out or setting up, are the main air and water hose to the pipe lines entering the heading, and the only labor is that of jacking the horizontal drill-bar tightly into position after it has been brought in and placed by the drill carriage.

All drill carriage track is riveted to steel plates so that the track may be cleared rapidly to within about 25 feet of the face after each shot, merely throwing the muck right and left. In the case of the muck-handling drill carriage the track is laid on one side of the heading while the other has its track down the centre. These machines save wear and tear on both men and machines, and made a surprising difference in the efficiency of both. With these machines the drills are in the heading ready to be jacked into place by the time the drillers have the loose rock barred down from the sides and roof and the muck thrown back sufficiently from the face to enable the bar to be set. Thus the time spent in setting up and taking down is much reduced. It is also notable that less muckers are required with this system than before the drill carriages were installed.

One drill carriage (see "B" Figure 12) is so designed that the cantilever arm is given its motion, longitudinally, transversely and vertically by motor-driven attachments. This machine remains in the heading after the drills are placed and has a bent conveyor running through it longitudinally, about 18 inches above the track, which elevates and dumps the muck into cars in the rear. This was used in heading N. 3-E (see Figure 14).

The effect of installing the muck-handling drill carriage is shown to a remarkable degree by the difference in progress obtained without any increase in force. For the six months prior to its installation the average progress in this heading was 350 feet per month. For the six months after the installation of the drill carriage the average progress has been 183 ft. per month. This is an increase of 38 per cent. Furthermore, it must be remembered that before the drill carriage was installed the heading was in limestone, for the greater part, while the drill carriage has been working almost exclusively in Essexite. The best month, May, 1913, was 510 feet in 27 working days. This heading is 10 feet high by 12.5 feet wide. The average yarding removed from this heading, including the 4 break-ups now working, is about 500 cubic yards, place measurement, per day. The linear progress in these break-ups is about twice that of the heading.

The other drill carriage used in heading No. 1-W (see Figure 15) has no motor attachment and is removed from the heading after the drills are



Figure 16.—Heading excavation, rear end of cantilever beam of drill carriage without conveyor, carriage removed for mucking and drilling in operation.

placed (see "C" Figure 12) leaving the cantilever arm attached to the drill bar and supported on a gallow's frame which leaves the heading open for mucking (see Figure 16). In this case the cantilever arm is advanced by the locomotive which pushes the drill carriage into the heading. The lateral and vertical movement are obtained by jacks and by hand. The progress with this carriage is almost identical with that of the other. The average progress over the entire job since the headings were started in the tunnel has been 420 feet per month in each heading. This makes no allowance for delays or lost time. It must also be remembered that for six months on the city end the blasting was restricted between the hours of 11 p.m. and 7 a.m. to avoid public annoyance. The average progress, where blasing has been unrestricted, has been 430 feet per month in each heading. From the time the first heading was started in the tunnel until the final meeting almost exactly fifteen months have been elapsed, giving a gross progress of 1,100 feet per month.

The general heading procedure is as follows:—

After a round of blasts has been completed the loose rock is barred down from the roof and sides and the muck (i.e., the broken rock) is thrown back from the face sufficiently to permit the horizontal bar and drills to be set up. These are erected, connected with the air and water lines and drilling commenced. From 18 to 24 holes, 5 to 8 feet deep, are drilled in the heading. In the meantime the muckers have cleared the tracks, and are shovelling the muck into the cars, or onto the conveying belt where the muck-handling drill carriage is used. Smooth steel plates, called slick sheets, are laid in the bottom of the heading to fall on, so that the muckers shovel on a smooth surface.

Where no drill carriage was used (see Figure 13) three muckers threw muck back from the face to the slick sheets and four shovelled it into the cars. These four men, one each shift of 8 hours, handled all the muck made in that shift. Thus, during the record month, each man handled from 12 to 15 cubic yards of muck per shift; which, considering that about two hours of each shift were lost in blasting, was a most unusual performance.

All blasts are fired electrical'y from the lighting current; the blasting switch and leads being carried on the opposite side of the heading from other electric wires. Where time fuses are not used the rounds are usually fired in four shots; 1st, the cut holes, which form the opening wedge; 2nd, the relieving holes, immediately surrounding the cut; 3rd, the line holes, which break the heading to its full width; 4th, the dry holes, which break the heading to its full height. Sometimes the line holes and dry holes are fired together when the ground is breaking well. Where time fuses are used, the cut is fired in the usual way with ordinary exploders so that if, as is very often the case, the cut does not break to the bottom at the first shot

it can be fired a second time.

After the cut has been fired the rest of the heading is loaded with time fuses, cut at two inch intervals, running in length from two inches up. Two of each length of fuse are used around the cut, the shortest fuses being closest to the cut and the longest being the two bottom corner holes so that the muck will be thrown back from the face by the last explosion. These fuses are ignited by electric igniters exactly similar in construction and resistance to the regular electric exploders. Thus all fuses are ignited simultaneously and regular exploders may be discharged at the same time if desired. This method saves time in blasting and leaves the men much fresher than if they had to go back into the smoke again and again. As all the fuses are very short the danger from cut-off holes is practically eliminated; in fact there has been no trouble from this source whatever thus far. This method is also used in all the break-ups.

In the heading a round of shots is fired from 3 to

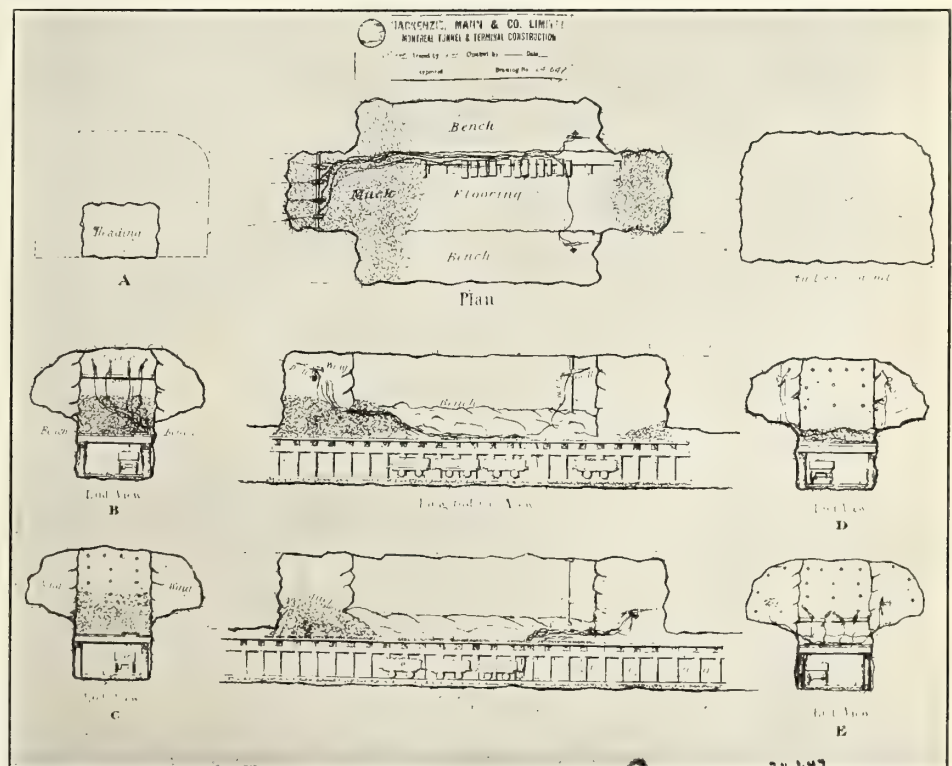


Figure 17.—Typical break-up procedure.

6 times a day (24 hours). During the record month, with three exceptions, six shots were fired every day.

Break-up Excavation.—The break-ups (see Figures 17 and 18) where the upper part of the tunnel section is excavated to its full width and height, are opened at intervals of 500 to 800 feet along the centre bottom heading. As many of these may be opened as are necessary to keep up with the heading progress, the advance in each break-up being about half that in the heading. In making the break-up excavation heavy jumbo timbers are framed into the heading, about two feet apart and planked over, so that as the rock is blasted down from above, it can be run through the jumbo timbers into the muck cars in the heading beneath.

In Figure 17, "A" shows the location of the heading in the tunnel section. The break-ups are advanced by carrying an entry, about 15 feet ahead of the wing wall excavation, the same width of the heading and to

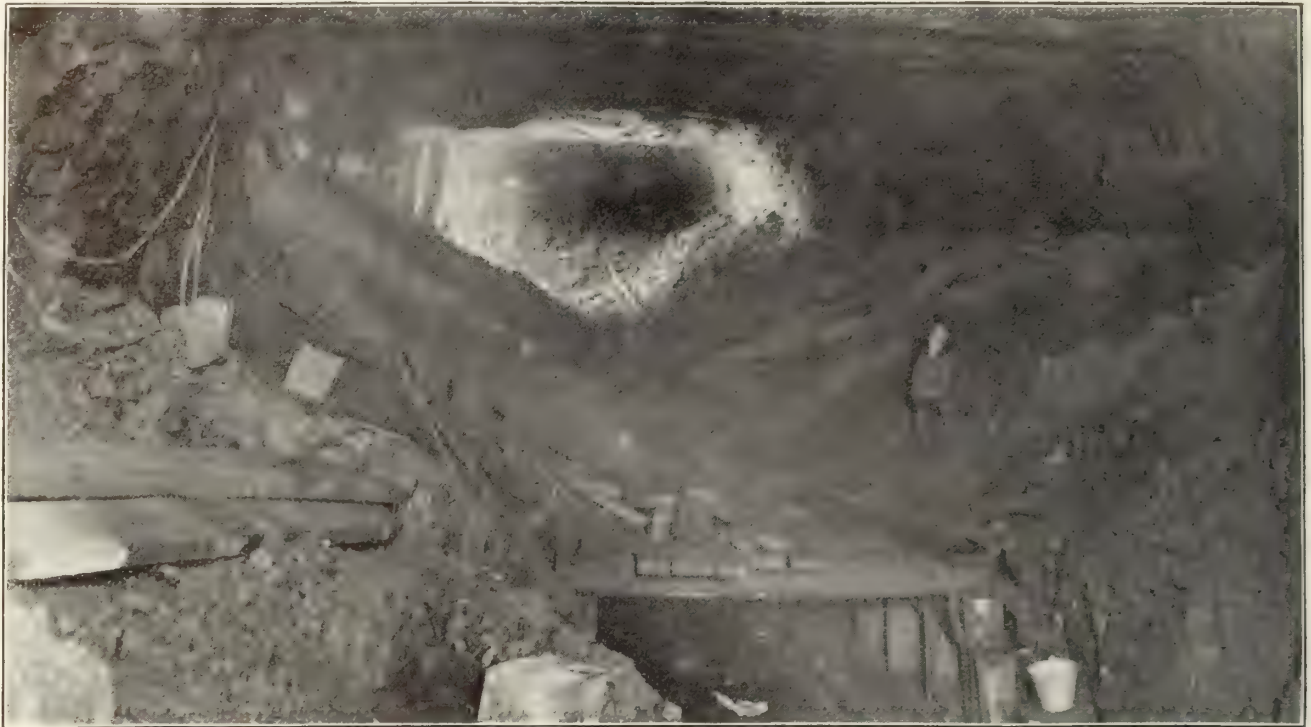


Figure 18.—Break-up excavation, showing bottom heading with jumbo timbers.



Figure 19.—O'Rourke concrete block arch, set up in shop, showing tenons.

the full height of the roof. As seen in "B" figure 17 a horizontal bar is used with 4 drills as in the heading. Immediately after shooting the bar is set up above the muck and the upper half of the entry is drilled. Then the bar is removed to the other end of the break-up, and while the upper half of that entry is being drilled the muck is removed from the first entry. Thus when the upper half of the second entry is drilled the bar may be set up again in the first entry and the lower half drilled (see "E" Figure 17). By the time this drilling is finished the muck is removed from the second entry and the lower half of that may be drilled. In the meantime two columns with a single drill on each are set up in the wings and these drilled so that all the drilling is finished at the same time.

In the limestone two drilling shifts will break all the ground that three mucking shifts can handle economically. As the blasting is always breaking to two faces the drilling is comparatively light and very little powder is required; the powder actually amounting to less than one quarter that required in heading work.



Figure 20.—Pneumatic concrete mixer.

The blasting in the breakups is done with time fuses which are ignited electrically, as already described. Thus it will be seen that the Break-up Excavation requires but little labor and explosive, being both rapid and economical. With four break-ups and one heading working at the back of the mountain the average excavation was about 500 cubic yards of place measurement daily, all of which goes out through the west heading to the main crusher plant.

A very important advantage of this method of tunnel driving described herein, as previously mentioned, is that where bad ground is encountered no material delay is experienced. The bottom heading progresses on through the bad material, which is treated carefully and at leisure later on. This saves much time in the ultimate completing, and much money and risk in the construction. Some bad ground in break-ups where heavy internal stresses developed in the roof, require considerable timbering. This will be all concreted in

with a reinforced single arch before the steam shovel reaches it, so that neither time nor money will have been lost.

In connection with the physical risk involved by this method it is interesting to note that within 15 months since the tunnel headings were started and with nearly a mile and a half of break-ups completed there has been only one fatal tunnel accident.

Bench Excavation.—The side benches, below the level of the jumbo timbers, are taken out, after the break-up excavation has been completed, by a steam shovel operated by compressed air. By this method the benches may be drilled and blasted well in advance and by a special loading device the usual delay in spotting cars is avoided, and no time will be lost by the shovel, making this excavation very cheap and rapid. At places where a steam shovel cannot be used because of timbering, special construction, or shield work, the benches will be handled by hand and a belt conveyor loading into the tunnel cars.

Shield Work.—At the city end where very soft

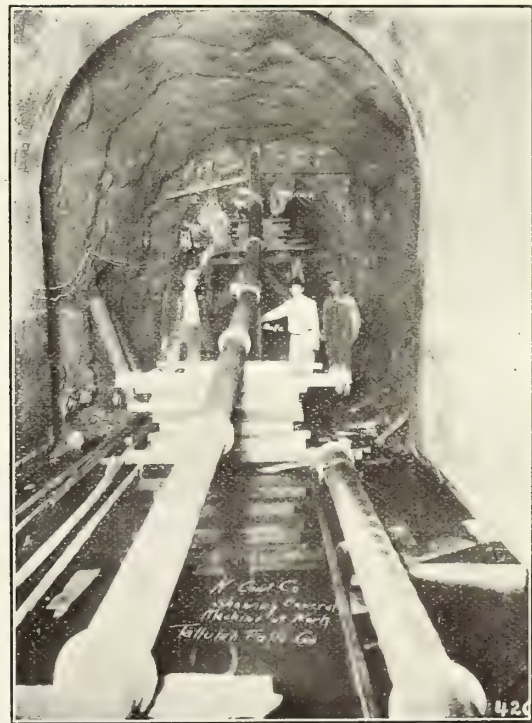


Figure 21.—Pneumatic concrete placing, in the Tallulah Falls tunnel where this process was used, which is to be tried on the Mount Royal Tunnel.

heavy ground is encountered under most unfavorable conditions, a steel roof shield has been adopted. This avoids settlement of over-lying material, reduces the drainage of the surrounding ground, and eliminates the very heavy and expensive timberwork that would otherwise be necessary. This shield consists of a cutting edge, shaped to conform to the outline of the tunnel roof cross-section, which forms the front of a steel envelope extending over the platforms on which the men work and back far enough to lap over the last "ring" or section of tunnel lining erected. Steel poling boards, semi-attached to the shield will be used, especially in the boulder clay, thus producing a cutting edge that may be advanced in sections where desired.

The shield is supported on steel columns forming the centre wall and on side walls which rest on the solid rock. It is forced ahead by hydraulic jacks, under a pressure of about 5,000 pounds per square inch.



Figure 22.—Crusher plant and tipples at West Portal.

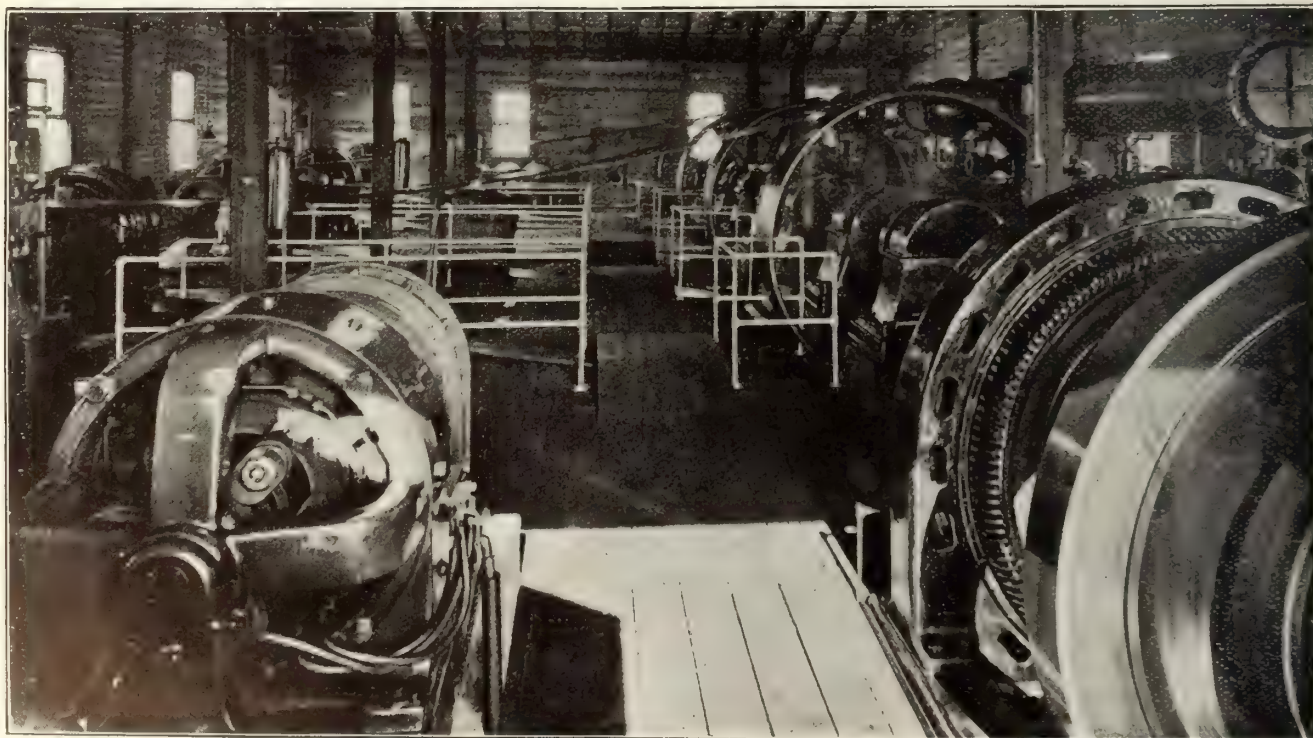


Figure 23.—Compressor house at West Portal.

These jacks push against the tunnel lining as it is erected.

The procedure is as follows:—after a shove, i.e., a move of the shield, 27 inches ahead, a ring of concrete blocks, 27 inches wide, along the axis of the tunnel, by 24 inches thick and about 5 feet long circumferentially, are set up in place by means of a hydraulic erector. When this tier of blocks is in place, the jacks are put in motion, jamming the new blocks hard against the last tier erected and forcing the shield slowly ahead, as fast as the ground is excavated in front of it. The excavated material, like that in the break-ups, is dropped directly into cars in the heading below. As soon as this shield has made a shove of 27 inches the process is repeated.

Where boulders are encountered the shield will be retarded and the steel poling boards advanced along the rest of the shield face for the 27 inch shove, when

thrusts of the jacks without injury. The blocks are also so designed that the extrados of the arch is continuous, but the joints in the intrados are about $1\frac{1}{4}$ inch wide. These joints are held to shape primarily by 3 part wedges or separators and later filled with mortar by means of a cement gun and grouting.

Pneumatic Concrete Lining.—At the back of the mountain and where the shield is not used it is proposed to try some experiments with mixing and placing concrete by means of compressed air. By this method ordinary forms are used and the concrete is conveyed from the pneumatic mixer (see Figures 20 and 21) to the forms through pipes by compressed air. If this method is successful it should very much reduce the labor required and prove to be both speedy and economical.

All forms used will be collapsible and movable so that they may be used repeatedly. Where convenient

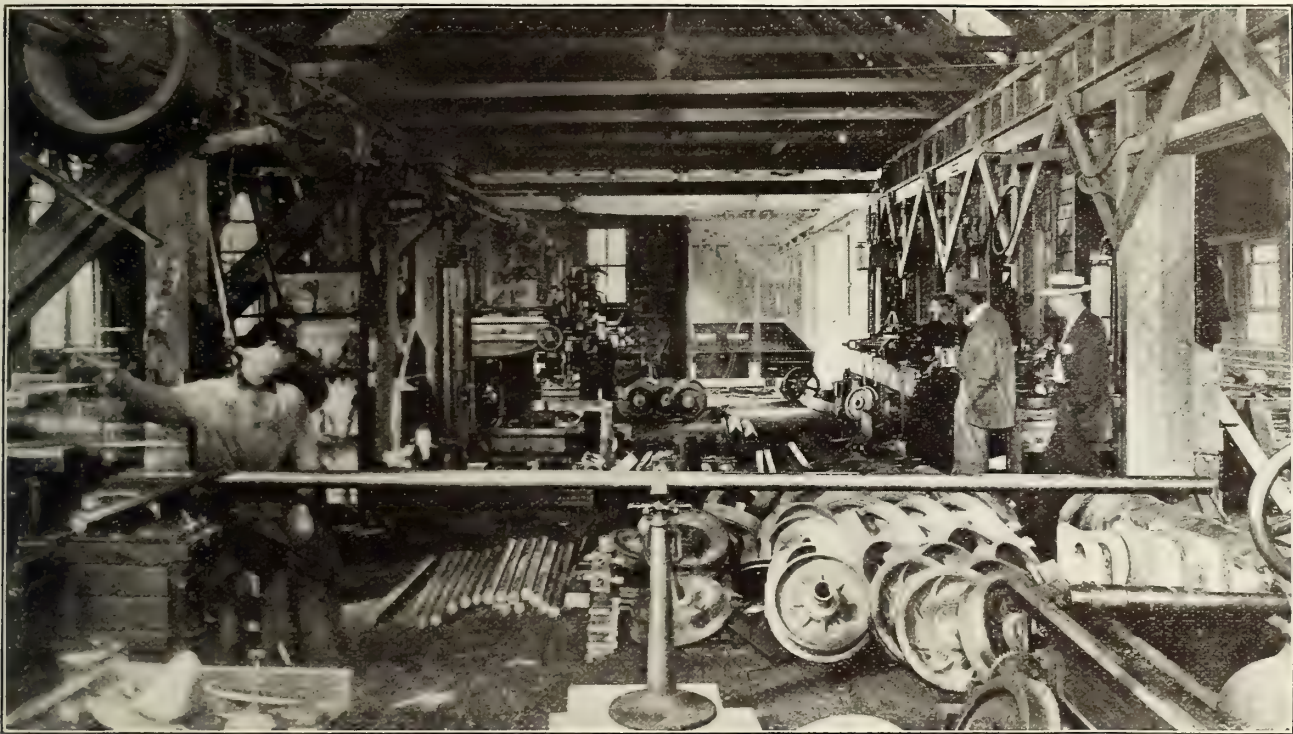


Figure 24.—Corner of machine shop at West Portal.

the boulder will have been removed in part or wholly. Where special rectangular sections are built, a steel structure will be erected and steel sheeting used over and around it. This steel sheeting will be advanced by jacks, the structural steel and enclosing concrete being placed under the sheeting as it advances. By this method the roof is never exposed; the men are never endangered by falling material, and if water is encountered the face can be protected by poling and breast boards with small pneumatic guns, or jacks, so that very little water or ground can escape.

The blocks used (see Figure 19) were invented and patented by John F. O'Rourke of New York, who built the Hudson (North) River Tunnels of the Pennsylvania R. R. They are very massive and so designed that each block locks firmly into the two adjoining ones of the preceding ring, by oval shaped tenons. They are thus self-supporting and require no forms such as are usually necessary for concrete work. Since they are moulded many weeks in advance, before being brought into the tunnel, when they are erected under the shield they are sufficiently hard to withstand the

and economical steel forms will be used with travelling mechanisms to reduce the labor in handling and setting.

Construction Plant

Crusher Plant.—All the rock excavated in the tunnel is being crushed for road material and concrete stone. All that is not used by the company or railway is sold for local consumption about Montreal. The main crusher plant at the west portal (see Figure 22) consists of two No. 7 Kennedy gyratory crushers with Stevens-Adamson elevators, conveyors and screens. The capacity is about 1,600 cubic yards per day. The tunnel muck is hoisted in cars up an incline to tipples. After dumping, the empties are returned to the tunnel level, though a gravity switchback. The muck passes through the crushers and is elevated to a revolving screen which separates the stone into the various sizes and distributes it by chutes into bins. It can then be run directly into trucks or cars on tracks connected with both the C. P. R. and G. T. R. The overflow is carried on belt conveyors to various stock piles for the different sizes of stone. From these piles the stone is

loaded by means of a locomotive crane and clam-shell bucket.

At the city end the tunnel rock is sold as it comes from the tunnel and crushed by an outside company.

Air Compressor Plant.—The compressed air used to operate drills, pumps and other pneumatic machinery is obtained from two plants (see Figure 23) one at each end; comprising an aggregate of 11,000 cubic feet of free air per min. compressed to 110 pounds per square inch. These plants consist of 8 cross compound compressors. Six are Blaisdell compressors, belt driven from Canadian General Electric motors, each compressor having a capacity of 1,100 cubic feet. Two are Sullivan compressors direct connected to Canadian General Electric motors, having a capacity of 2,200 cubic feet each. The power is purchased from the Montreal Light, Heat & Power Company at 2,300 volts, 60 cycles.

Shops.—Quite elaborate shops were equipped in order to make the job independent of local shops for repairs, and because it was cheaper to build the tunnel

electric tunnel locomotives, interchangeable from 5 ton storage batteries to 8 ton trolley locomotives; 215 tunnel cars, including all types; one Browning 45 ton 8-wheel locomotive crane; two Lidgerwood mine hoists with Eagle Iron Works automatic dumping shaft cages; the usual equipment of derricks and hoisting engines; one 7½ ton Commer auto truck; one 3 ton Alco auto truck; two Ford run-arounds; one 30 horse-power Cadillac touring car.

Drills.—The main drilling equipment consists of Sullivan percussive (reciprocating) drills fitted with a water attachment for hollow steel. Many details of these were designed especially for this work and are giving remarkably good results. The best light hammer drill found is the Hardy "Simplex." It is a 25 lb. self-rotating drill that has given most satisfactory results. A few numerous other makes of drills were tried or purchased principally for experimental purposes.

Miscellaneous Plant.—Cameron reciprocating pumps are used, and are, as always, satisfactory. Root blowers are used for ventilating. Berger surveying in-



Figure 25.—General panorama at West Portal, showing plant and camps.

cars, of special design, on the job, than to buy them ready made. There was also special machinery such as the drill carriages to be built that would have been more complicated in an outside shop. It was found, too, that in the company's shop, three electric tunnel locomotives could be built for the price of two from the regular manufacturers and being built to special design enabled them to be used as 5 ton storage battery locomotives or 8 ton trolley locomotives, with very slight changes and at short notice. The shop equipment consists of 3 Ward drill sharpeners; one air operated steam hammer; a combined shear and punch for plate work; 3 lathes 60 in., 24 in. and 12 in. respectively; two 36 in. radial drills; two small power drill presses; two 24 in. power hack saws; one pipe and bolt machine; one shaper; two emery wheels; two large grind-stones; one oxy-acetylene apparatus; two band saws and two circular saws with the usual equipment of pneumatic and other small tools (see Figure 24).

Transportation Plant.—The transportation plant consists of one American saddle tank 30 ton "Dinkey" locomotive; two ten ton and one eight ton General Electric trolley locomotives for the tunnel; six 5 ton storage battery tunnel locomotives; two home-made

struments are being used with most accurate and satisfactory results.

Synopsis

Mount Royal Tunnel.—Length, 3 1-10 miles; heading in station site, 1-3 mile; grade, 0.6 per cent. down towards the city; section, 23.5 feet high by 31 feet wide, standard excavation; type, twin tube; depth, 600 feet below summit; geology, Trenton limestone and Essexite with igneous dykes; method, bottom centre heading and break-ups; progress, best single heading 810 feet in 31 working days, averaging 420 feet per month in each heading; gross average 1,100 feet per month.

ESTIMATED QUANTITIES

Tunnel.—Excavation, 20,000 cubic yards of earth, 405,000 cubic yards of rock; concrete, 50,000 cubic yards; steel and iron, 4,400,000 lbs.; shafts, Maplewood, 240 feet deep, Dorchester, 55 feet deep; present pay-roll, 1,000 employees; present daily consumption of 60 per cent. dynamite, 2,000 lbs.; present daily rate of solid excavation, 900 cubic yards.

Terminal Site—Exclusive of Terminal Buildings.—Length, 1,200 feet; width, 350 feet; depth, 50 feet maximum; total tracks, 13; excavation, 540,000 cubic yards

earth, 95,000 cubic yards rock; concrete, 100,000 cubic yards retaining walls, track, slabs and platforms; reinforcing steel, 3,500,000 lbs.; structural steel, 8,000,000 lbs.

Mount Royal Heights Station.—Length, 500 feet; depth, 35 feet maximum; excavation, 24,000 cubic yards earth, 7,000 cubic yards rock; concrete, 7,000 cubic yards.

ENGINEERING AND CONSTRUCTION ORGANIZATION

S. P. Brown, Managing Engineer for Mackenzie, Mann & Company, Limited, Chief Engineer of the Canadian Northern Montreal Tunnel and Terminal Company, Limited.

DEPARTMENT OF DESIGN

Electrical.—W. C. Lancaster, Electrical and Mechanical Engineer; R. H. Wheeler, Asst. Electrical Engineer; P. A. Fawell, Electrical Draftsman; J. F. Faber, Electrical Draftsman.

Structural.—H. D. Robinson, Engineer of Structural Design; C. M. Gray, Assistant Designer; W. E. Joyce, Assistant Designer; Ray Wick, Assistant Designer; W. P. Best, Chief Draughtsman; F. A. Guenther, Draughtsman; J. E. Stata, Draughtsman.

DEPARTMENT OF SURVEYS AND ALIGNMENT

Howell T. Fisher, Tunnel Engineer.

Eastern Division.—J. L. Busfield, Assistant Engineer; R. R. Stevenson, Instrument Man; W. H. Abbott, Level Man; two assistants.

Western Division.—R. S. Bassett, Assistant Engineer; A. F. Duguid, Instrument Man; C. F. Doore, Level Man; two assistants.

Inspectors.—G. C. Leclair, Chief Inspector; W. A. Gilmour, M. W. Maxwell, and J. J. McNulta; two assistants.

DEPARTMENT OF ACCOUNTS

C. C. La Bree, Managing Accountant; R. L. Munro, Cashier; H. L. Horne, Chief Storekeeper; A. E. Strugnell, Chief Time Keeper.

PURCHASING DEPARTMENT

F. B. McFarren, Purchasing Agent; J. P. McGuire, Asst. Purchasing Agent.

DEPARTMENT OF CONSTRUCTION

J. C. K. Stuart, First Assistant Engineer; Rufus Gent, Master Electrician and Mechanic; John B. Elwood, Efficiency Engineer.

Eastern Division.—Edward Duffy, General Superintendent; C. Phillips, Day Walking Boss; F. Braison, Night Walking Boss; A. Brown, Asst. Master Mechanic; C. Griffen, Chief Electrician; E. Bosslet, Boss Carpenter.

Western Division.—Richard Byers, General Superintendent; Wm. Irwin, Night Superintendent; E. R. Farrell, Day Walking Boss (Portal); Edward Farrell, Day Walking Boss (Shaft No. 3); T. Litterini, Night Walking Boss (Portal); J. Penders, Night Walking Boss (Shaft No. 3); W. R. Tiner, Asst. Master Mechanic; W. T. Leslie, Chief Electrician; R. Robinson, Yard Boss; O. Sinclair, Boss Carpenter.

DEPARTMENT OF BUILDINGS

C. Gordon Mitchell, Inspecting Architect; W. W. Kissock, Photographer.

MEDICAL DEPARTMENT

Mackenzie and Mackenzie, Limited, in charge. J. P. Mitchell, M.D., Visiting Doctor; J. Guy W. Johnson, M.D., Supervising Doctor, East; A. J. Charette, M.D., Supervising Doctor, West.

Paints and Their Applications

BEFORE a recent meeting of the Vancouver Branch of the British Columbia Society of Architects, Mr. H. H. Welch, local manager of the British America Paint Company, Vancouver, discussed paints and their applications in the course of an interesting paper, conveying many practical points in relation to the subject. Corroded white lead, defined basic carbonate of lead, was really a combination of hydrated lead oxide with lead carbonate in the proportions of one of the former to two of the latter, though these proportions were varied extremely. A theoretically correct composition of white lead was very dense and opaque and quite white (though not so white as oxide of zinc) and any excess of either chemical constituent impaired its color and quality. Describing the "old Dutch" or "stack" as being the oldest and perhaps the best process in the several methods of corroding lead, Mr. Welch told how metallic lead was melted, cast into perforated discs or buckles about 6 ins. in diameter, which were put into earthen pots containing about a pint of vinegar or diluted acetic acid. These were placed in rooms holding several layers of many hundred pots each, the latter being covered with boards and layers of spent tan bark placed between each layer of pots. The rooms or stacks were kept closed for about one hundred days during which the heat and carbonic acid generated by the fermentation set up combined to corrode the lead more or less completely into a flaky white substance. After this it was crushed, screened, floated, washed in water and dried, the result being the white lead of commerce which was afterwards ground in raw or refined linseed oil and sold for general painting purposes.

Other processes of manufacture dealt with included the cylinder or quick process in which the molten lead is blown into fine granules by steam; and the Dahli process which consists of slowly pouring the molten lead into cold water, thus reducing it to a thin fluffy condition. This was then placed in stationary tanks from which a stream of diluted acetic acid was continually flowing which eventually took it up and converted it into basic acetate of lead. A stream of carbonic acid was passed through this solution thereby precipitating the lead in the form of basic carbonate. Lead corroded by this process was finer and whiter and took up more oil in grinding than other leads but lacked the dense opacity of corroded lead. There were other processes of obtaining white lead but these were the methods generally used. Mr. Welch proceeded to examine the main characteristics of basic carbonate white lead, and regarding the boiling of oil said there were several methods, the prevailing one being the so-called "bung hole" boiling which was a pernicious practice, as no good lasting job could result.

The oxidation of paint was of the utmost importance, because the absorption of oxygen by the linseed oil entirely changed it from a fluid to the tough leathery coating so necessary for the purpose of preservation. In this process of oxidation the linseed oil gained in weight about 16 per cent. The life of a good paint varied, but should not be less than three years. The speaker went on to deal with the creosote stains for shingles, pointing out that while a good wood-preserved, creosote was a poor binder for the pigments used in making stain. It was very penetrating, with the result that the vehicle penetrated into the cedar and left the coloring matter on the surface with no binder to hold it on.

The Proposed Extension of Toronto's Waterworks System

IN a recent issue of the Contract Record brief reference was made to the report issued by Mr. R. C. Harris, Commissioner of Works of the City of Toronto, in the proposed extensions of Toronto's waterworks system. The publication of this report has given rise to a good deal of discussion regarding the merits of the alternative proposals, and also of the original solution of the problem as offered by the board of experts appointed by the city in 1911, in their report of May, 1912. We publish herewith a summarized report setting out the main points upon which the respective schemes differ, supplemented by the chief points raised in the criticism. As our readers will remember, the board of water commissioners consisted of Mr. J. G. Sing, of Toronto (chairman); Mr. Willis Chipman, of Toronto (secretary); Mr. Isham Randolph, of Chicago, and T. Aird Murray, of Toronto. The following synopsis will convey the principal features of the scheme recommended in the report by the board of experts, which provides for the installation at Scarborough Heights of an intake, tunnel, filtration plant and reservoir, with gravity feed mains to the city, the total estimates therefor amounting to \$5,320,000.

A pumping plant five miles east of the present city limits; and at a point two mile to the south of this plant, in Lake Ontario, and at a depth of one hundred feet an intake crib of concrete and steel was to be sunk, having a diameter of 110 ft. at the base and a height of 115 ft., at an estimated cost of \$500,000. The Commission recommended that the intake crib be connected with the shore pumping station by a two-mile tunnel 10 ft. in diameter, to be constructed in the shale of the Hudson river formation at a depth of 160 ft. below the lake surface at an estimated cost of \$633,600.

The board of experts proposed to establish a pumping station adequately protected, at the foot of Scarborough Cliffs, the pumping machinery to comprise four electrically-operated pumps each of 15,000,000 Imp. gal. capacity for 24 hours, electric current to be transmitted to the new pumping house from the municipal hydro-electric sub-station to be erected at the south-east corner of Gerrard street and Carlaw avenue, a distance of about eight miles. It was recommended that in order to avoid the possibility of interruption to the service another independent source of electric power should be obtained, preferably from the River Trent. With these pumps it was proposed to elevate the water to a reservoir and filtration plant 355 and 370 ft. respectively, above the lake level. A 130,000,000 gallon reservoir at an estimated cost of \$1,071,000, was also proposed, the supply to be allowed to gravitate through a steel conduit varying in diameter from 78 ins. at Scarborough to 66 ins. at the high-level pumping station on Cottingham street.

Extracts from Commissioner Harris's Report

The following is a summary of the report issued a couple of weeks ago by the Department of Works, City of Toronto. The report condemns the Scarborough scheme as recommended in the 1912 report of the Commission appointed by the city in 1911 to investigate the problem, and a proposal is made covering

the installation of a plant at Victoria Park to filter and pump directly into the mains.

In the Commissioners' report it is proposed to build an intake crib off Victoria Park, 5,100 feet from shore. The crib will be approximately 110 feet in diameter, constructed of steel and concrete, and surmounted by a house, the main part of the crib rising 19½ ft. above the lake, the crib to contain the necessary ports for the admission of water. The inside of the crib will contain a vertical steel shaft, lined with cement or brick-work, running down to the proper depth below lake level, so as to connect with a tunnel 6,380 ft. long, running horizontally to the shore at Victoria Park. The internal diameter of the shaft would be 11 ft., that of the tunnel 9 ft., the latter to have its invert 105 ft. below mean lake level. At the shore there will be a vertical shaft 10 ft. in diameter rising above the normal lake level at this point. From the vertical shore shaft there will be two horizontal, 7-ft. tunnels, one on each side and parallel with the shore. One of these tunnels will supply the suction side of the pumps in the station to be erected, the other will act as a reserve to be used in case the size of the station is increased later.

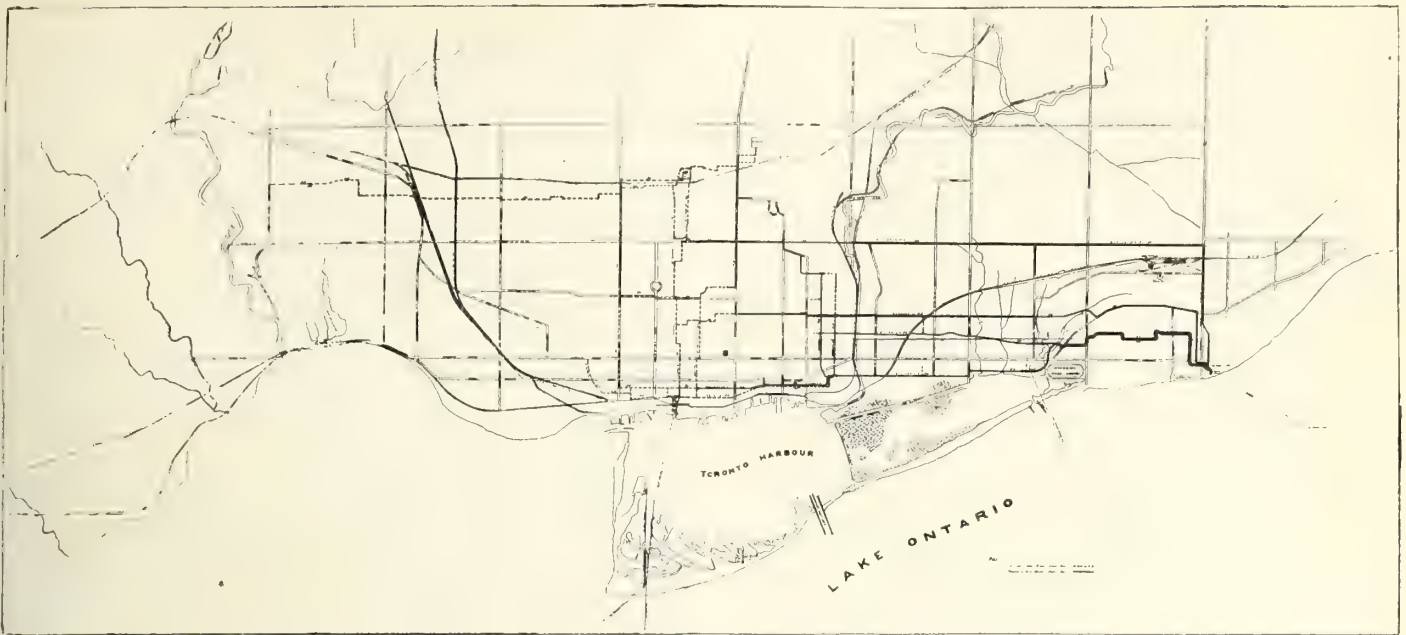
The pumping station, which will have a capacity of 60,000,000 Imp. gals. for the 24 hours, will be located in Victoria Park, which with the piece of land to the east, is of sufficient size to contain a station and filtration plant of 120,000,000 Imp. gal. capacity for 24 hours, should such a capacity ever be required.

Since the water will have to be filtered the station must be divided into two parts, viz., low-life and high-lift, the former taking the water from the tunnel shaft and delivering directly to the filters, while the latter will deliver the filtered water direct to the city mains. Each part will have a capacity of 60,000,000 Imp. gal. The low-lift pumps will work against a head of approximately 75 ft., while the approximate head on three of the high-life pumps will be 220 ft., or 95 lbs. per sq. in., and that of the fourth pump about 315 ft., or 137 lbs. per sq. in.

The mechanical type of filter is recommended, and in connection with this it is proposed to instal a reservoir with a capacity of two-and-a-half-million Imp. gal., and to provide space for a settling basin should the make of filter require it. From the station four 36-in. pipes will deliver water to four new 42-in. mains which join the present distribution system.

Briefly the plan contemplates: 1. A system which will supply an additional quantity of water equal to that now being used during maximum draft, thus practically duplicating the present plant. 2. A system which will operate in exact harmony with the existing plant, thus enabling both to work in conjunction. 3. An arrangement which can be doubled in capacity without doing unnecessary work. 4. A supply which is unfailing, in so far as human agency can make it. It will not be deleteriously affected by storms, ice, shifting sand, etc. 5. A supply of water, which is as pure as it is possible to obtain in the vicinity of Toronto, and which after treatment will be safe and satisfactory. 6. An improved service throughout the entire city. 7. An attractive park on the waterfront.

In the opinion of the Department of Works an ad-



General plan of the City of Toronto, showing existing large mains and proposed new mains.

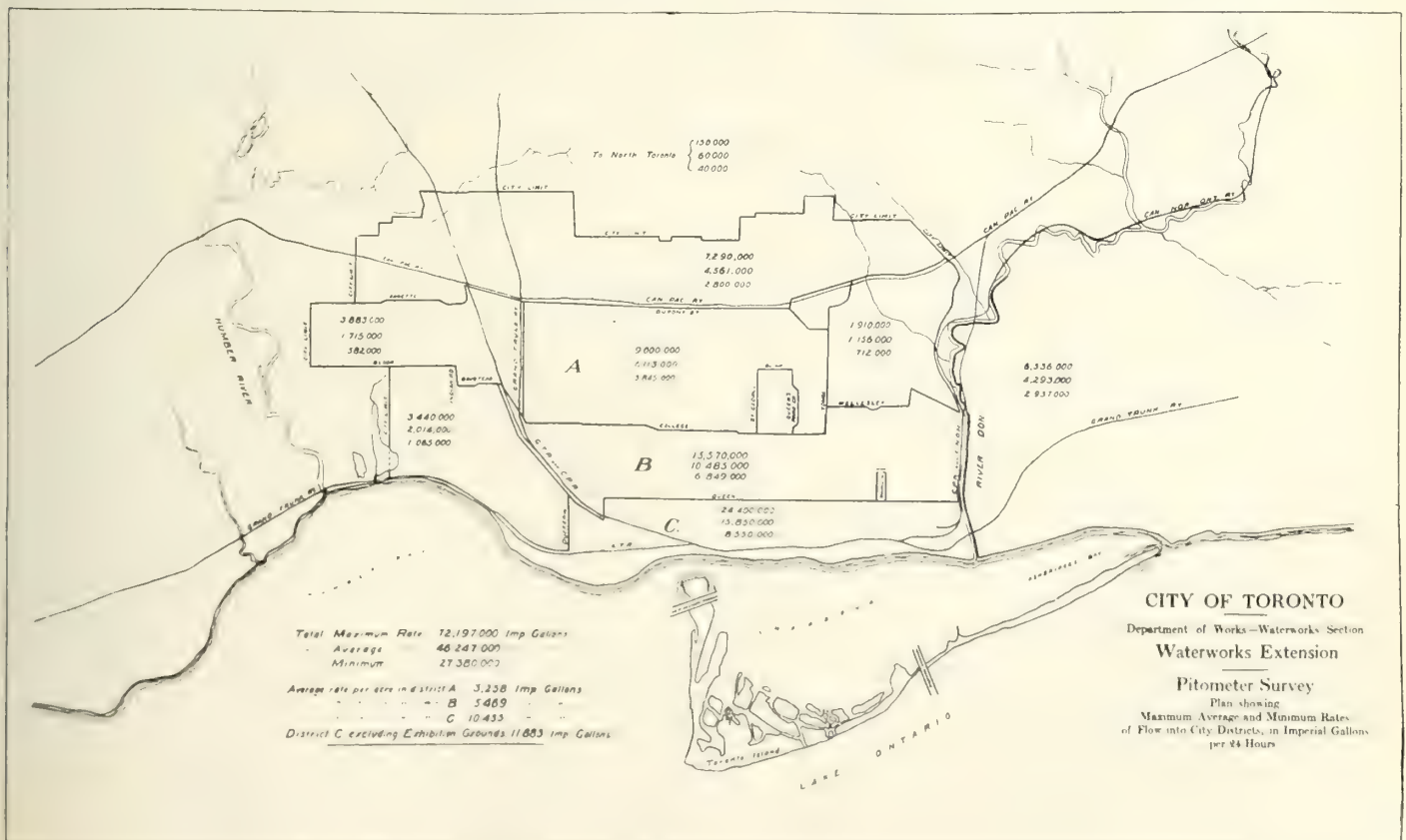
ditional reservoir for the city is not essential, but it is desirable that there should be some water storage to provide for fluctuations in demand from time to time. This storage has already been adequately provided for in the Rose Hill reservoir which has ample capacity for all the present and proposed pumping equipment. The present Rose Hill reservoir has a capacity of $39\frac{1}{4}$ million Imp. gal. or about 20 hours supply at the present average daily pumpage of approximately fifty million Imp. gal. and is quite sufficient to compensate the ordinary fluctuations of discharge.

From the pump house there will be four 36-in. pipes, with Venturi meters, running a short distance from the station, after which they will be enlarged for

distribution purposes, and will feed four 42-in. mains, all of these pipes being cross-connected and controlled by valves in such a way as to make a perfectly flexible arrangement.

The discharge pressure on the pumps at the high-level station supplying the middle district is 65 lbs. per sq. in., and hence, after making allowance for friction and difference of level, the pressure at the Victoria Park station on the pump supplying the 42-in. main will be approximately 137 lbs. per sq. in. While this pressure is higher than usual, yet the pipe rises rapidly after leaving the station, and only about 2,000 ft. of it would be subjected to a pressure of over 100 lbs.

It is held that this distribution plan will give ample



accommodation for the water for the new station to reach all points of the city, and will enable the new station to work in perfect harmony with the present plant. In addition to the supply feature, provision is made for 32 miles of large distributing mains, at a cost of approximately \$2,393,000. The following are the main items in the estimated cost of the project as recommended:

Lake crib—complete and placed	\$400,000
Lake shift, tunnel and short shaft	800,000
Site and buildings	500,000
Pumping equipment	380,000
Tracks and overhead equipment from York to pumping station	35,000
Twenty-six miles of distribution mains	2,040,000
Filtration plant	600,000
Levelling, grading, etc.	5,000
Six miles of distributing mains—high level pumping station to West Toronto, for part of which contracts have been awarded	353,000
Additions to high-level pumping station, and provision of steam reserve sufficient for ultimate output of this station, for part of which contracts have been awarded	250,000
which with a few minor items make a total estimated cost of \$6,033,700.	

Defence of the Experts' Scheme

Mr. Willis Chipman, Secretary of the board of experts responsible for the preparation of the Scarborough report, commenting on Commissioner Harris's remarks said:—"There is nothing in the Scarborough scheme suggested by the board of experts for the extension of the Toronto waterworks system that cannot be solved by the ordinary principles of hydraulics." While admitting that the Victoria Park scheme recommended by the Commissioner as a substitute for that advocated by the experts contains some good features, Mr. Chipman pointed out that its greatest weakness was that it was proposed to take water from the lake at a point where the water was polluted by sewage only 2½ miles from the main sewer outfall at Morley Ave., whereas in the Scarborough scheme it was proposed to obtain water from a point seven miles from the sewer outfall. He admitted that if the citizens were prepared to drink "doctored" water there was no valid reason why they should not take the water from the Bay, now that sewage was not dumped therein. Such water could undoubtedly be purified by chlorination, but it was likely to have an unpleasant taste. He had always refused and would continue to refuse to be a party to taking any kind of water for domestic purposes simply because it might be purified by a process. If the Commissioner's scheme were adopted it necessarily followed that water obtained from that source would be, roughly, twice as impure as that obtained at the present intake, as an evidence of pollution by sewage was found to be extensive within a radius of over five miles from the present intake pipe.

Mr. Isham Randolph, also of the board of experts, said he had noted that Mr. Harris seemed deeply concerned in discrediting the work of the experts. Mr. Randolph took exception to many of the deductions drawn by Commissioner Harris. It was true that some of the recommendations made by the experts did not follow proved practice, but if in the development of the world's mechanical and structural creation proved practice only had been followed, what would have been the state of civilization to-day? The Commissioner's objection to the proposed tunnel under the lake he con-

sidered out of place, as this was quite feasible and practicable. In Chicago a tunnel had been constructed 163 ft. below water surface, while the water tunnel under the Hudson river at Catskill was 1,100 ft. below water surface.

Another gentleman in close touch with the work of the experts expressed the opinion that in voting for the money by-law last year for waterworks extensions the ratepayers thought they were voting for the extension of the Scarborough scheme recommended by the experts. He thought in the event of the city council adopting Commissioner Harris's scheme it would be within the province of any taxpayer to apply to the courts for an injunction to prevent the execution of the work until the people were given another opportunity to vote the money.

Progress at St. John, N.B., Greatest in a Quarter of a Century

Correspondence of the Contract Record

WITH building permits to the value of \$2,380,000 last year the city of St. John made greater progress in construction work than in any year for a quarter of a century. The Metcalf Construction Company completed a million-bushel grain elevator for the Canadian Pacific Railway Company and has since practically completed the erection of grain conveyors from the two elevators to two additional steamship berths. The splendid new armory, which had been begun in the previous year, was completed and is now occupied by the Militia. The new Imperial Theatre, the finest east of Montreal, fronting on King Square, was completed. The Merchants' Bank of Canada purchased a building and added another storey, completely remodelling the whole structure, and Bank of British North America has now nearing completion at the corner of Dock street and Market Square a very handsome bank building of concrete and steel. Speaking of banks it may be noted also that the Bank of Montreal remodelled its premises at a cost of \$30,000, while the Royal Bank has now nearing completion a branch building in the north end, constructed of concrete. The Ames-Holden McCready Company, Limited, erected a seven-storey warehouse on Water street. The Federal Government is completing a new observatory on Douglas Avenue.

Of large structures not yet completed are the sugar refinery, one of whose largest buildings is approaching completion, and the new post office, of which the steel frame is now being erected. Men were engaged throughout the summer and fall and well into the winter in getting the foundation for the post office, as it had to be blasted out of the rock to a depth of nearly twelve feet below the sidewalk, and the work was especially slow and tedious. The Rhodes, Curry Company, Limited, are erecting this building and the work on the sugar refinery has been carried on by the Foundation Company and the Dominion Bridge Company. The task of securing foundations both for the sugar refinery and the C. P. R. grain elevator was a very heavy one, as in both cases it was necessary to go deep to get a solid foundation, and in both cases the harbor water interfered to some extent with the prosecution of the work.

One of the heaviest construction works of the season was the placing in position of the immense timber cribs to make the foundation for three new wharves, of which the surface is to be of concrete. Owing to an

average tidal variation of about twenty feet, and the fact that there must be thirty feet or more of water at extreme low tide, it is necessary to have timber cribs of great depth. During a tremendous storm in the early winter two of these great cribs were detached and went adrift into the harbor. They were captured and grounded, but are still there, and it may be necessary to take them in pieces and rebuild the whole structure. The federal government has cancelled the contract of Messrs. Connolly & Charleson, and will immediately make other provision for the construction of these cribs.

Fairly good progress was made last year in constructing the concrete foundations for the new street railway and traffic bridge, to connect east and west St. John, and it is stated that the Dominion Bridge Company will begin work on the superstructure early next summer. It is said that this will be the longest span-drill arch bridge in the world, and the work of construction will be attended with the greatest difficulty. At Courtenay Bay, in the eastern harbor of St. John, Messrs. Norton Griffiths & Company are making progress with the immense breakwater, but have had great difficulty and many mishaps to their plant in connection with the very large dredging contract, to make a channel into Courtenay Bay and a basin inside the breakwater. In fact they have only done a little dredg-

has been at work for the past year on the foundation and piers of a bridge across the Miramichi river, which will have a span of about 1,250 feet and for which it is necessary, because of the depth of water and the nature of the bottom, to construct piers some sixty feet below the level of the water, and then place them upon piles driven into the clay below. The general manager of the company says that this bridge is the most considerable undertaking in bridge construction that has yet been started in the eastern provinces, but the sub-structure will be completed in its essentials in March next.

Reviewing the building situation in New Brunswick generally, it is noted that there was general activity in all the towns last year, and that the prospects for this year are very good.

Hollow tile for partitions is made in two grades known as porous and semi-porous, the result of mixing in the clay a proportion of sawdust which burns out, 20 per cent. of sawdust being used in the semi-porous, and 25 to 35 per cent. in the porous. This leaves the finished product in such a condition that it can be cut with a saw and nails can be driven into it, says Henry G. Tyrrell in Engineering Magazine. The semi-porous is used for partitions with about 40 per cent. of full porous ones to hold the nails where trim is needed. Solid or dense tile is suitable for floors but not for par-



New Armoury at St. John, N. B.

ing at the mouth of the channel, and a much more extensive plant must be put in commission this year.

The St. John Railway Company has extended its line in two directions for a short distance out of town and will this year make further extensions; and it is announced that as a result of this several building companies will take up the work of constructing groups of houses, which are greatly needed to relieve the congestion caused by a growing population. The city will probably have as great activity in construction work this year as last. The city council will continue its policy of making permanent streets, and will have a bill before the legislature next month asking authority to make the abutters along the streets pay half the cost of the permanent work.

Outside of the city of St. John, the Foundation Company now have men at work at several points on the St. John river seeking to find a foundation for the great bridge over which the St. John Valley Railway will cross the St. John river. Another immense bridge must be constructed over the Kennebecasis river, and it is expected that the provincial government will lay before the legislature a proposition concerning this work, which will cost considerably in excess of a million dollars. At Newcastle, the Foundation Company

titions, excepting perhaps in outside exposed positions, and wood nailing strips must then be inserted if nailing is needed. The blocks are made either 12 inches square or in either form, 12 inches long and 4 to 8 inches deep, but the large square ones can be laid much faster than the smaller ones and at a less labor cost.

The new building in New York city for the Consolidated Gas Company will have its facades illuminated at night by concealed lights in such a way as to give a most brilliant effect. Another new feature, and an interior detail that we understand has never been tried before, will be the lighting of the large hall, which is reached from the main entrance in Fifteenth street. Here there is a series of Pavanazda marble arches, in each of which are several panels of the same marble a quarter of an inch thick. Behind these panels there will be concealed lights which will shine through the marble panel work, producing a most remarkable lighting effect. The new building is fireproof, and in this connection what is said to be an absolutely new system has been worked out and approved for the carrying of wires, telephone, high tension, electric light, gas and other pipes through combination boxes built in the floors.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

It is officially stated that the Union station at Quebec, and the improvements and terminal facilities at St. Malo, will be commenced on May 1.

The City of Maisonneuve, Montreal, have purchased a block of land lying between Sherbrooke Hill and Rosemount Boulevard for \$1,500,000 to complete the 400 acres available for a park to serve the east end. The entire cost so far is \$2,500,000.

An opportunity for starting a brick-making plant would seem to be available in St. John, N.B., where a bed of clay of large area and from 23 to 26 feet thick, with a clay or sand formation underneath, has been located near Fairville, N.B. The land is owned by the city.

Mr. H. A. McLean, town engineer of Sarnia, is engaged on the new \$250,000 waterworks system for that district. Several other important works have been carried through under Mr. McLean's guidance, notably the new electric lighting plant which was recently installed at Forest, for which he is also consulting engineer.

The Dominion Steel plant, Sydney, N.S., which had been closed two weeks for repairs, re-opened on January 26, and the general manager has announced that sufficient orders have been received to keep the works going at full output until well into the summer. The firm have an order on hand for the Australian Government.

The Controllers of the city of Montreal have been authorized to issue a loan for two million dollars for the purpose of establishing and maintaining an electric plant, in connection with the enlargement of the aqueduct. Part of the power generated will be used for pumping water, and part for a municipal lighting plant.

On the advice of the law department, the Controllers of Montreal will hold an administrative investigation into the causes of the recent break in the conduit. The Controllers will await the granting, by the Quebec Legislature, of powers to enforce the attendance of witnesses, and examination under oath, before opening the inquiry.

Mr. Macallum, city engineer of Hamilton, has announced the preparation of plans which might do away with the necessity of the proposed new sewage-disposal plant at the extreme east end of the city. His new plan involves an enlargement of the existing plant at Trolley street with a new pumping station at the foot of Kenilworth street.

The appointment of a Parks Purchasing Committee for Toronto was again advocated in the annual report of the executive committee of the Toronto Civic Guild, read before the annual meeting recently. Among the suggestions was one that a board of experts be appointed to study the question of assessing the cost of such improvements as new streets, street widening, etc.

The Hamilton board of control have passed on the new building by-law to the city council. The principal objection to the by-law as framed was that all but first-class fireproof buildings were prohibited erection in the central business district, which was considered a hardship and likely to curtail

building operations. The controllers have amended it so as to provide for the erection of second-class buildings in the districts specified.

The Exchequer Court, with Hon. Walter Cassels presiding, is conducting proceedings in Toronto for the expropriation of Adelaide street property to be used as a site for the new general post-office. Although nothing definite has yet been announced it is understood that the new building will take in the entire block bounded by Victoria, Lombard, Church and Adelaide streets.

On March 3 the City of Montreal will call for tenders for the construction of the fourth and last section of the civic filtration plant at Point St. Charles, the plans of which have been drawn by Messrs. Hering & Fuller, of New York. The cost is estimated at \$150,000, the work including the pumping station, the wash-water tower, the superstructure of the filter building, and the gate-houses. When completed, the plant will cost \$1,350,000.

Owing to depression in the building trade throughout the west the Canada Cement Company have decided to close down their plants at Marlbank and Lakefield, Ont., and Calgary, Alta. Two other operating plants of the same company, one at Winnipeg and one at Exshaw, will continue to operate. The circular sent out by the general sales manager at Montreal merely states that the plants will remain closed until the end of the present year unless demand warrants earlier re-opening.

Norton Griffiths & Company, of London, Montreal, and St. John, N.B., have, in conjunction with W. H. Brown & Company, New York, made an offer to the Mayor of Chicago to organize a company with power to issue \$150,000,000 worth of 5 per cent. bonds for the purpose of building and operating a system of subways. The first unit would consist of thirty miles. After operating, maintenance, interest and sinking fund, and a 3 per cent. dividend, 55 per cent. of the surplus is to go to the city and 45 per cent. to the operating company.

Next June it is proposed to hold a national town-planning congress in Toronto with the object of considering measures for the carrying out of a uniform system of town-planning. At the fifth annual meeting of the Commission of Conservation the report of the advisory committee, which for some time past has been investigating with a view to formulating a scheme applicable to all provinces, was presented and the draft bill submitted, the latter containing a proposal to create local town-planning boards in each municipality to co-operate with the central authority.

The Executive of the Great Waterways Union of Canada, at a meeting held in Berlin, Ont., on January 22, passed a resolution tendering the Dominion Government its appreciation for the prompt and business-like action it has taken in the construction of the new Welland Canal as a link in the waterway from the ocean to the Great Lakes. A further resolution was passed urging upon the government that in the event of the appointment of a Royal Commission to investigate the commercial feasibility of the Georgian Bay canal, western Ontario and the prairie provinces, being more

vitaly interested than any other parts of Canada, be granted full representation, and that such investigation be made to cover the entire route from the Georgian Bay to Montreal.

By striking out the paving clause the Private Bills Committee of the Quebec Legislative Council have restored to its original position the Montreal bill as regards the special tax for street paving. The clause as adopted leaves the question of cost to the decision of the majority of the Montreal City Council. If the majority is against the levying of the special paving tax the city will have to pay out of the loan account. By the old paving law the cost was provided by special tax on property owners. Now the clause leaves this optional for the Board of Control to get what terms they can with the majority of the Council.

Contract procedure is criticized in the fifth section of the Civic Survey report on the Toronto Department of Works. The report in this respect is based upon an analysis of about two hundred contracts and in view of the facts disclosed the committee recommend among other things that more care be given to the preparation of the engineer's estimate of quantities and total cost, that the right to extend the time limits on contracts be vested solely in the board of control, and that the practice of undertaking contracts before their final execution, and beginning the work before the issuance of the formal order, be discontinued.

The Methodist Book & Publishing Company are immediately commencing work upon excavations for the new buildings on John, Queen and Richmond streets, Toronto, the cost of which, when completed, will total close on \$1,000,000. With a Gothic style of architecture the base course to a height of eight feet will be of granite, and thence to the roof white glazed terra cotta will be used. The floors will be of reinforced concrete and hollow tile construction, and all frames used will be of bronze. It will be a five-storey structure but provision will be made for the addition of another five if required. The contract for the structural work has been awarded to the John H. Parker Company, Limited, New York and Toronto, the price being about \$600,000.

Quebec Architects' Annual Meeting

The members of the Architects' Association of the Province of Quebec held their annual meeting recently in the city of Quebec. The report submitted stated that 21 new members had been admitted. The Quebec section reported a satisfactory year, and the hope was expressed that the city may be induced to accept the building by-laws recommended by the association. It was suggested that the Quebec legislature should amend the statutes in such a way that qualified architects might be put on the same footing as other professions and that they might be admitted before the courts of justice to prove professional services rendered by oath instead of in writing. The association's income was \$2,903 and expenditure \$2,685, the total balance being \$3,643. During the discussion the question of the present method of taking off quantities was mentioned. This will probably be considered during the current year. At present each contractor tendering on a job takes off his own quantities, which involves a considerable cost. In Great Britain the work is done by quantity surveyors, and it is contended that this is a cheaper and more satisfactory system. The following officers were elected: president, Mr. W. S. Maxwell, Montreal; vice-president, Mr. Joseph Perrault, Montreal; second vice-president, Mr. Staveley, Quebec; secretary, Mr. J. Emile Vanier, Montreal; committee: Mr. D. M. MacVicar, Mr. Frank Peden, Mr. D. MacFarlane, Mr. E. Payette, and Mr. G. A. Monette. The delegates elected to the Royal Architectural Institute were: Mr. John Archibald, Mr. H. Marchand, Mr. Alcide Chausse, Mr. G. A. Monette and Mr. Edward Maxwell.

WESTERN CANADA

Edmonton hospital board require \$62,000 to enable them to complete the new south wing of the building, this amount not having been provided for in the money by-law passed for the purpose.

A movement is on foot for the Board of Trade, the City Council and the Saskatchewan Industrial League to co-operate to assist industries locating in Regina, and to provide capital to help them extend their business.

A new detention shed of steel construction, with brick walls and concrete floors, is to be erected at Vancouver for the Dominion Immigration Department. The contract has been awarded to Snider Brothers at \$277,449.

If the suggestions of the Regina Chief of Police are carried out, several new sub-police stations will be erected in Regina during 1914; an up-to-date signal system will be installed, and numerous other improvements made. A new police station to cost \$180,000 will also be erected.

Much interest is manifested in Regina in the natural gas proposition which has been practically accepted by the city council. According to the terms of this agreement, the city will secure natural gas at twenty cents per cubic foot. With natural gas at this price, it is claimed that power rates for milling enterprises, etc., would be reduced to a minimum. The gas will be secured within one hundred miles of Regina, and piped to the city.

Manitoba's scheme to expend two and a half million dollars on road improvement has been brought before the legislature by Hon. Dr. Montague, Minister of Public Works. The government will provide 33 1/3 per cent. of the cost of ordinary roads and wooden bridges and 50 per cent. of the cost of gravel roads and permanent bridges. The money is to be spent under the supervision of a commission of three members to be appointed later.

The Assiniboia council, it is reported, have rescinded a contract awarded on December 3 to the Bitulithic Paving Company for the paving of seven miles of road from the Assiniboia city hall. It appears this company's tender was \$29,000 higher than that of the National Paving and Construction Company. The contract will be re-let and a deputation is to wait on the provincial government regarding the granting of sectional aid for the construction of the road.

One of the largest dyking schemes ever undertaken in western Canada has been commenced by the Sumas Dyking Commission. The project involves 30,000 acres of land in the Fraser Valley, B.C., and the estimated cost is set down at nearly a million and a half dollars. The contract has been given to the L. M. Rice contracting firm of Seattle, Wash., and it is anticipated that the scheme, when completed, will open up one of the finest agricultural territories on the mainland of the Vancouver province.

On May 18-23 the first Canadian and International Road Congress will be held in Montreal. It will be attended by delegates from all parts of the Dominion. Several papers will be read, including one by Mr. W. A. McLean, provincial engineer of Ontario.

Mr. Paul D. Sargent, Chief Engineer, State Highway Commission, Augusta, Me., recently delivered an illustrated lecture on "Gravel and Its Use in Highway Construction" before the Graduate Students in Highway Engineering at Columbia University.

Mr. W. A. Mahoney, architect, Guelph, has opened an office in the Bank of Toronto Building, Berlin, Ont.

Canadian Railroad Development

The new C. N. R. branch from Prince Albert to Battleford, Sask., was officially opened on January 19.

It is understood that the Canadian Northern Railway Company has secured control of the Quebec and Sauguenay Railway and that the former will erect extensive tunnels at Quebec, alongside the proposed terminals of the Canadian Pacific Railway.

Mr. F. P. Guteluis, general manager of the Intercolonial Railway, anticipates that during the next three years the entire 185 miles of the line between Halifax and Moncton will be double-tracked at an estimated cost of five millions. It is expected that fifty miles of the road will be done this year.

It is announced that an organization meeting has been called for February 14 of the Terminals Company that is to build the new Union Station at Toronto. Mr. Kelley, vice-president of the Grand Trunk Railway, assured the Dominion Railway Commissioners that plans for the station and the viaduct would be ready shortly.

An indication of the development going on amongst the various railway companies is afforded in the fact that during 1913 the railways have had under consideration 6,000 miles of new line. The Canadian Pacific has at present over 1,000 miles in hand, the Canadian Northern nearly 2,000 and the Grand Trunk Pacific about 1,000. The active work has been for the most part in three of the western provinces, and the following is the mileage possessed by the principal companies in these parts of the Dominion.—C. P. R., 1,675 in Manitoba; 2,633 in Saskatchewan; 1,597 in Alberta. C. N. R., 1,863, 2,021 and 795 respectively, and Grand Trunk Pacific, 314, 1,025 and 681 respectively. Altogether there are about 19,000 miles of railway in the Dominion and an estimate places the probable mileage next year at 35,000.

Personal Mention

Mr. Charles Hamilton Mitchell, C.E., has been elected president of the Toronto Civic Guild.

Mr. John Bingham, a well-known and highly respected Toronto contractor, died on January 22, in his 64th year.

The late Mr. Geo. C. Watson, who was a well-known Toronto builder and contractor, left estate valued at \$36,055.

Messrs. James Cowin and E. F. Fee have formed a partnership in Winnipeg and intend specializing in reinforcing steel.

Mr. L. H. Bennett has received an appointment as school architect with the Regina public school board, at a salary of \$2,500 a year.

Mr. J. Lanning, B.A.Sc., has been appointed a superintendent in the smelter works of the Mond Nickel Company, at Coniston, Ont.

Mr. J. T. Whitlam, chief building inspector of Toronto, has been seriously indisposed for some days, but his condition is now substantially improved.

The late Mr. Andrew D. Harris, president of the Ontario Sewer Pipe Company, Mimico, Ont., who died December 12, left estate valued at \$257,426.

Mr. Geo. Spencer, of the Winnipeg staff of the Railway Commission, has been transferred to Ottawa to succeed the late Mr. A. J. Nixon as chief operating officer of the board.

Mr. R. MacKay Fripp gave an interesting discourse on "National Character as Expressed by the Architecture of the Home," under the auspices of the Housing Association in Vancouver on January 18.

Mr. Frank A. McInnes, formerly of Fredericton, N.B., and now chief engineer of the sewage and water division of

the Public Works Department of Boston, has been elected president of the New England Water Works' Association, succeeding Mr. J. Waldo Smith, chief engineer of the Board of Water Supply, New York. Mr. McInnes is a graduate of McGill University.

Mr. G. Janin, chief engineer of the city of Montreal, has been granted a long leave of absence owing to illness. He has recovered from an attack of congestion of the lungs, but suffers from heart trouble.

Mr. Stanley M. Oborn, Toronto, and Mr. B. E. T. Ellis, who formed a partnership recently as consulting and civil engineers, will have two offices, one in Toronto in charge of Mr. Oborn, and one at Hamilton with Mr. Ellis in charge.

Mr. T. Rowland has been appointed hydrographic engineer for the Nicola District of British Columbia. He will reside at Nicola immediately and proceed to complete surveys of the district with a view to the development of irrigation.

Mr. G. R. B. Elliott, of Vancouver, was awarded the S. H. Hedges cash prize for his essay on the "Fraser River Delta," at the twelfth annual meeting of the Pacific North-West Society of Civil Engineers held in Seattle, U.S.A. Mr. Elliott has the distinction of being the first Canadian to secure the award.

Toronto Firm's Activities in Woodstock

Mr. J. L. Mitchell, manager of the Mitchell Crusher Manufacturing Company, Toronto, who for the last two years has been manufacturing his Mitchell improved crushers, screens, elevators and dump cars, in Toronto, as well as in New Hamburg, has succeeded in consolidating his Company with the Woodstock Wind Motor Company, of Woodstock, Ont. Mr. Mitchell obtained from the City of Woodstock a \$20,000 loan for the purpose of installing new machinery in the present Wind Motor plant and also for erecting an addition to the building to accommodate a full line of concrete and road-building machinery, including concrete mixers, tile and concrete block machines, which will give to Woodstock one of the largest plants of its kind in the Dominion. Mr. Thomas Watson will be the general manager of the new company, which will be known as The Concrete Machinery Manufacturing Company, Limited. Having had several years' experience as a manufacturer of concrete machinery, Mr. Watson is entitled to credit for his efforts in bringing this important industry to the city of Woodstock, where it is hoped that his efforts will be attended with much success. Associated with him in the starting of the new company will be Mr. Mitchell who expects to go to England in the near future where, we understand, he has made arrangements to build the Mitchell improved crusher. The entire output is at present taken and disposed of as fast as completed, by Messrs. Wettlaufer Brothers, of Toronto. That the market is not by any means confined to Canada is proved in the fact that several shipments have been made from time to time to various parts of the British Empire (including Australia and South Africa) and also to Central and South America.

Morris Overhead Runways

Some very interesting recent installations of Morris overhead runways are dealt with in Bulletin A-12 which we have just received from the Herbert Morris Crane and Hoist Company, Limited, Empress Works, Peter Street, Toronto. Reproductions of some excellent photographs of these runways bear testimony to the flexibility and handiness of the system employed. The Morris runway is shown in the warehouse, paper mill and foundry, and the modification of the equipment to suit varying conditions is very interesting.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aylmer, Que.

Owing to a technicality the by-law which was passed recently was declared defeated. Another by-law will be submitted in about a month.

Chesley, Ont.

Certain alterations and additions to the waterworks system are being discussed by the town council.

Galt, Ont.

The town council in conjunction with the South Waterloo County Council have under consideration the construction of a concrete and iron subway on River Rd. at the junction of Lake Erie and Northern & Brantford St. Railway.

Kerrobert, Sask.

Tenders addressed to the Sec.-Treas. J. W. Lauman, will be received until 2 p.m. Feb. 28th for—(a) laying water-mains (approximately 3 miles); (b) pump house; (c) steel water tower, foundation of water tower, housing of steel water tower; (d) water pipes and specials; (e) valves and hydrants; (g) pumping machinery; (i) well and galleries. Plans and specifications may be seen at Kerrobert, or the offices of Con. Engineers, Chipman & Power, 47 Canada Life Bldg., Winnipeg, and Mail Bldg., Toronto, Ont., on and after Feb. 2nd.

London, Ont.

The city council proposes paving Wellington street from G. T. R. tracks to river. Seven blocks, concrete or asphalt pavement.

Montreal, Que.

Plans for the installation of a filtration plant at an estimated cost of \$150,000 having been drawn, L. N. Senecal, Sec., Board of Commissioners, will receive tenders on March 3rd. Plans and specifications at offices of the Engineers, Her-ring and Fuller, 170 Broadway, N.Y., and the City Engineer.

Ottawa, Ont.

The time for receiving tenders for the supply of steel pipe in connection with the water supply system has been extended to Feb. 20th. Tenders will be left unopened until after a new plebiscite is taken.

A sub-committee comprising Ald. Brethour, Ald. Fisher and City Engineer, has recommended that in future water meters be installed in all business buildings.

Sudbury, Ont.

Tenders addressed to W. J. Ross, council clerk, will be received until 6 p.m. Feb. 28th, for the construction of 8240.9 lin. ft. granolithic sidewalks.

The town council has under consideration the laying of pavements on seven streets.

The town council will call tenders immediately for the laying of 6,184 lin. ft. sidewalks.

Sandwich, Ont.

At a meeting of the Essex Council it was decided to postpone the projected road improvements until later on in the year.

Toronto, Ont.

A Bill providing for the extension of Terauley street, from College street to Davenport road, at an estimated cost of \$1,250,000, has been passed by the city council.

The York Twp. Council has ordered the survey of the southern part of the Twp. between Dufferin and Yonge Sts., with a view to the installation of a sewerage system.

The contract for sewer work on Felstead St. and Danforth Ave., awarded to J. O. Jerou, having been cancelled, the Board of Control will shortly call new tenders.

The contract awarded to National Contracting Co., 9 Garnock Ave., for Annette street sewer (\$8,688) having been cancelled, new tenders will be shortly called by the Board of Control.

The contract awarded to Fussell-McReynolds Co., Dundas St., for \$53,465, having been cancelled, the Board of Control will call new tenders for Argyle St. storm sewer Sec. No. 1.

The recommendation that the Board of Control award to the Bessemer Lime-stone Co., the contract for Bessemer Dun Wire Cut vitrified paving blocks—40 blocks per sq. yd., at \$3,050 per M., has been referred back to the Commissioner of Works.

Tenders addressed to the chairman Board of Control, Mayor H. C. Hoeken, will be received until noon, Feb. 17th, for the construction of the following sewers: Lappin and Hallam Ave., storm overflow sewer from Lappin Ave. and Emerson Ave to Hallam Ave., and Salem Ave. via Lappin Ave., Dufferin St. and Hallam Ave. Danforth Ave., Main St. to east city limits. Specifications, etc., may be seen at office of Commr. of Works.

Vancouver, B.C.

Tenders addressed to Jas. Stuart, City Purchasing Agent, will be received until 4 p.m. Feb. 4th, for the supply of 3,312 ft. 18 in. cost iron pipe, 12 ft. lengths; 1818 ft.—18 in. cost iron pipe, 9 ft. lengths; 8 junction pieces, 6 ft. long, with gland fittings at one end for connection purposes.

Windsor, Ont.

The city council has passed a bylaw providing for laying pavements on Eln. Wellington, Jeanette, Cameron, McEwan, McDougall, Langlois, Ann and Victoria Sts.

Winnipeg, Man.

A contract for the supply of cast iron water pipe and specials was recommended

by the Board of Control to be awarded to American Cast Iron Pipe Co., Birmingham, Ala., U.S.A., but has been referred back to council and may be given to Canada Iron Corporation.

Contracts have been awarded by the Board of Control to E. F. Campbell, Supt. of Asphalt Construction, No. 2, for sewer in Haskins Ave., at \$5,959.42, and Thos. Kelly & Sons, 504-5 Lindsay Bldg., for sewer in Ash Ave., at \$34,868.

CONTRACTS AWARDED

Twp. Sandwich East, Ont.

A contract for the supply of 4 in. field tile pipe has been awarded by Walker Sons, Walkerville, to Thomas Chick & Son, Windsor.

Toronto, Ont.

A contract has been awarded by the Board of Control to The Sun Co., Morris Bldg., Philadelphia, Pa., for the supply of Massachusetts asphalt at \$19.80 per net ton, 3 per cent. tare allowance.

A contract for sewer brick has been awarded by the Board of Control to Ontario National Brick Co., Montreal. Team delivery per M., Dist. No. 1, \$10.50; Dist. No. 2, \$10.50; Dist. No. 3, \$10.75. Car delivery per M., f.o.b., C. P. R., \$9.25; car delivery per M., f.o.b., G. T. R. \$9.75.

Contracts have been awarded by the Board of Control to Jennison-Wright Co., Toledo, Ohio, 4 in. x 4 in. blocks, yellow pine, at \$2.40 per sq. yd., and to Canadian Creosoting Co., C. P. R. Bldg., 3 in. x 4 in. blocks, Norway pine, at \$2.05 per sq. yd.

The following contracts for sewers have been awarded by the Board of Control. Connolly Agnew Constr. Co., 606 Avenue Rd., Annette street, at \$13,400; Boon Ave., \$2,334; Hope Ave., \$2,984; Runnymede Rd., \$24,600. National Contracting Co., 9 Garnock Ave., Day Ave., at \$1,888. Glenn & Dunne, 169 Indian Rd., Earls court Ave., at \$1,579; Goodwood Ave., \$1,182; Harvie Ave., \$2,149; Nairn Ave., \$1,518; Sellers Ave., \$1,847; Wade Ave., \$707. Commissioner of Works, Gerrard St. and Hiawatha Rd., at \$44,250. Fussell-McReynolds Co., Dundas St., Main St., Gerrard to North City Limits, at \$66,500. W. E. Taylor, lane 1st south of College St., from McCaul, at \$384; lane 1st south of Dupont, from Manning Ave., at \$641. Asphaltic Concrete Co., 74 King St. E., lane west of Roncesvalles Ave., at \$225.

Contracts for water mains have been awarded by the Board of Control to M. H. Murphy, 84 Dominion St., for laying and jointing 36 in. water main, Sec. "A," at \$33,597.75; Sec. "C," at \$26,576, also 20 in. main on Clinton St., at \$2,695; and to Godson Contracting Co., Sec. "B," 36 in. main, at \$39,895.

The following contracts for street grading have been awarded by the Board of Control to Ramsay Contracting Co., on Ardagh Ave., \$700; Grant Contracting Co., on Hallawell Ave., \$235; Britnell

Contracting Co., on Mann St., \$165; Britnell Contracting Co., on Spring St., \$1,005. Commr. of Works, on Colina Ave., \$673; Minto St., \$1,704, and Connolly St., \$354.

Railroads, Bridges and Wharves

Euphemia Twp., Ont.

A report on the subject of the proposed construction of several new bridges is to be prepared immediately. Clerk, D. M. Smith, Cairo.

Galt, Ont.

The Central Presbyterian Church authorities have been authorized to build a wall on church property which adjoins the river.

Gatineau Pt., Que.

Mayor Lafontaine will interview the Government, Dept. of Public Works, with a view to the construction of a breakwater along the shores of Gatineau River to protect property from floods.

Gananoque, Ont.

Tenders addressed to R. C. Desrochers, Sec. Public Works Dept., Ottawa, will be received until Feb. 23rd, for the construction of stone approach and macadam road, plank walk and steps, pile wharf, etc. Plans may be seen at office of Dept. in Ottawa, Postmaster at Gananoque, and J. G. Sing, Confed. Life Bldg., Toronto, Ont.

Goderich, Ont.

The Govt. estimates will contain an amount for dredging the harbor, etc.

Guelph, Ont.

Tenders addressed to A. Simmers, Telephone Bldg., Douglas St., Guelph, will be received until Feb. 28th for the construction of a suspension foot bridge over the Speed river from Riverside Park to Wellington Place.

Hamilton, Ont.

Tenders for the construction of a reinforced concrete bridge will be received by the Mayor until February 19th.

Kingston, Ont.

The City Engineer, R. J. McClelland, has recommended to the city council the construction of a concrete breakwater on King St., West, at an estimated cost of \$30,000.

The City Council will have plans drawn immediately for the construction of a timber wharf on Clarence St. Estimated cost \$5,000 to \$6,000.

London Twp., Ont.

The township council propose constructing the following concrete and steel bridges at the specified approximate cost between Con. 6 and 7, one span \$2,000; Con. No. 1 between lots 6 and 7, one span, \$1,200; Con. 6 and 7, two spans, \$4,000; Con. 12, one span, \$1,400; Con. 14, one span, \$1,100; Con. 15 and 16, one span, \$1,400.

Merrickville, Ont.

Tenders addressed to L. K. Jones, Sec. Railways and Canals Dept., Ottawa, will be received until noon Feb. 12th, for the construction of a concrete dam. Plans at office of Chief Engineer, Ottawa, and Supt. Engineer of Rideau Canal, Birks Bldg., Ottawa.

Montreal, Que.

The Montreal Harbor Board is applying to the Govt. for a loan of \$15,000,000

to cover cost of new docks, sheds, elevators, elevation of tracks, etc.

Nootka Island, B.C.

Tenders addressed to R. C. Desrochers, Sec. Public Works Dept., Ottawa, will be received until Feb. 26th, for the construction of a wharf. Plans, etc., at office of Dist. Engineers, New Westminster and Victoria, B.C., with Postmaster, Nootka and at Dept., Ottawa.

Port Arthur, Ont.

Tenders addressed to Secretary, R. C. Desrochers, Public Works Dept., Ottawa, will be received until 4 p.m., March 2nd, for extensions to the new breakwater. Plans, etc., at offices of District Engineer, Confederation Life Building, Toronto, Port Arthur, Post Office, Montreal, and Post Office, Quebec.

Port Dover, Ont.

It is thought probable that the Govt. estimates will provide for improvements to the harbor.

Prince Albert, Sask.

The City Council has under consideration the construction of a viaduct system at an estimated cost of \$85,000. The engineer, Angus Smith, has prepared a report. Clerk, C. O. Davidson.

Prov. of Quebec

Tenders are being called by the Municipal Council of Ste. Claire, Sec.-Treas., A. Chabot, for the construction of a 2-span concrete and steel bridge over the Etchemin river. The estimated cost is \$25,000.

Quyon, Que.

Tenders for the construction of a wharf addressed to R. C. Desrochers, Sec. Pub. Works Dept., Ottawa, will be received until Feb. 26th. Plans, etc., at office of Dist. Engineer, Shaughnessy Bldg., Montreal, Postmaster, Quyon, and at Dept., Ottawa.

St. Catharines, Ont.

The by-law granting the Canadian Northern Ry. a bonus of \$100,000 to build a line from Toronto to Niagara through St. Catharines, was defeated by the ratepayers, January 28th, 1914.

St. Valier, Que.

Tenders for extension to the wharf addressed to R. C. Desrochers, Sec. Public Works Dept., Ottawa, will be received until Feb. 23rd. Plans, etc., at offices of Dist. Engineers, Montmagny, Que.; Post Office Bldg., Quebec; Postmaster Ste. Valier, and at Dept., Ottawa.

Thurso, Que.

Tenders addressed to R. C. Desrochers, Sec. Public Works Dept., Ottawa, will be received until Feb. 18th, for the construction of a wharf. Plans, etc., at office of Dist. Engineers, Shaughnessy Bldg., Montreal; Post Office Bldg., Que.; with Postmaster, Thurso, and at Dept., Ottawa.

Toronto, Ont.

Of the five designs submitted for the Gerrard St. bridge, the Board will recommend to the council that design No. 5 be chosen and that new tenders be called at once.

The Grand Trunk Ry. Co. intends to erect a roundhouse at foot of Spadina Ave.

Wallaceburg, Ont.

The contract for the construction of the ferry docks for the Wallaceburg

Ferry Company has been awarded to Norris Gibb.

Walkerton, Ont.

A committee of the town council has been appointed to meet the County Council to discuss the advisability of widening the two steel bridges.

Whitby, Ont.

An American Syndicate has had a conference with the council regarding the establishment of a car ferry from Whitby to Olcott, N.Y. Large harbor improvements will be necessary should the project be carried out.

CONTRACTS AWARDED

Prov. of British Columbia

The G. T. P. Rly. has awarded to J. A. MacKenzie & Co., 73 Exchange Bldg., Vancouver, the contract for the substructures of 12 steel bridges, on line between Prince Rupert and Hazelton.

St. Louis, Sask.

The G. T. P. Rly. has awarded to Jno. Gunn & Sons, Bank of Nova Scotia Bldg., Winnipeg, the contract for the construction of a concrete bridge over South Saskatchewan river.

Public Buildings, Churches, Schools, etc.

Belleville, Ont.

The time for receiving tenders for interior fittings at the post office has been extended to Feb. 7th. Plans at office of Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, with Caretaker, Public Bldg., Belleville, and at Dept., Ottawa.

Bentnick Twp., Ont.

Separate tenders addressed to School Sec. No. 3, J. W. Vickers, R. R. No. 1, Hanover, will be received until Feb. 16, for red brick and red pressed brick school building. Estimated cost \$7,000.

Elmira, Ont.

Plans are being prepared by Colwill, Tanner & Co., Traders Bank Bldg., Guelph, for a church for the St. James Lutheran Congregation.

Fort William, Ont.

Work on the Customs House on May St. N., will start again in spring.

Guelph, Ont.

The General Hospital Board has under consideration certain alterations to the hospital, and tenders are to be called as soon as the plans are ready.

Hanover, Ont.

The Lutheran Church Congregation contemplate erecting a church to seat 600 people, at an estimated cost of \$18,000.

Hamilton, Ont.

McPhie, Kelly & Darling, Architects, Bank of Hamilton Bldg., have been instructed to prepare plans for the erection of a new building for St. Peters Church. The estimated cost is \$35,000.

Ingersoll, Ont.

The King St. Methodist Church Congregation will shortly have plans prepared for a solid brick construction Sunday School.

Tenders are to be called shortly for additions and alterations to the post office.

Kentville, N.S.

The Presbyterian Church Congregation, Pastor, Rev. R. B. Layton, has under consideration the erection of a new church at an estimated cost of \$15,000.

Middleton, N.S.

Tenders addressed to R. C. Desrochers, Sec. Public Works Dept., Ottawa, will be received until Feb. 23rd, for the erection of a public building. Plans, etc., at office of Wm. Bishop, Clerk of Works, Halifax, Postmaster, Middleton, and at Dept., Ottawa.

Moncton, N.B.

The Roman Catholic Church have under consideration the erection of an edifice for which R. A. Frechet will be the architect.

Midland, Ont.

Tenders are to be called in the spring for the erection of a public school building. Architects, Stewart & Witton, 7 Hughson St. S., Hamilton, Ont.

Montreal, Que., Outremont

Plans will be submitted to the council about March for the erection of a new fire station, and if accepted, tenders will be called immediately.

Montreal, Que., Westmount

Architect invites tenders for general contractor and also separate tenders till Feb. 10th, for the erection of a church for the Dom. Sq. Methodist Congregation. Estimated cost, \$175,000. Architect, H. Barr, 23 Guy Block, Montreal.

Saskatoon, Sask.

The Salvation Army has chosen a site on 19th Ave. for the erection of a home at an estimated cost of \$20,000. The ratepayers will be asked to authorize a by-law granting a donation of \$4,000.

Ottawa, Ont.

Plans are being prepared for improvements and alterations to the basement of First Ave. Presbyterian Church, at a cost of \$4,000; a heating plant is to be installed at a cost of \$2,500; and plans are in progress for the erection of a new Sunday school at an estimated cost of \$14,000. Architect, J. Albert Ewart, 193 Sparks street.

Tenders for addition to the university will be received by Sec., Rev. J. L. Binet, until Feb. 6. Plans and specifications at offices of the Architect, C. P. Meredith, and MacLean Daily Reports, 220 King St. W., Toronto.

Peterborough, Ont.

The Board of Control has been asked for an appropriation of \$10,000, for the erection of a sanitarium for the Peterborough Health Association.

Sherbrooke, Que.

Plans have been drawn and submitted to the St. George's Club for the erection of a new building on the site of that recently destroyed by fire.

Stratford, Ont.

The Baptist Church Congregation are considering an extension to the present building or a Mission Hall may be built.

A committee has been appointed to interview H. B. Morphy, M.P., with regard to the advisability of enlarging the post office.

Sudbury, Ont.

The Separate School Board are about to have plans for the new school re-

vised and tenders will probably be called about March 20th. The specification includes two storeys and basement, 60 x 150, 12 rooms, concrete and face brick construction, concrete foundation, waterproofed, felt and gravel roofing, electric lighting, hot air or hot water heating, etc.

Swift Current, Sask.

Tenders addressed to J. T. Dodds, Sec.-Treas., will be received until Feb. 21st, for the erection of public school buildings in the centre and east end of the city. Separate tenders for heating, plumbing and electrical work are also called.

Toronto, Ont.

It is proposed to make extensive alterations to the R. C. Hospital on Bond St., and addition will be made to south side on Bond St. and Nurses' Home on Victoria St. The estimated cost is \$150,000.

The erection of a parish house, at an estimated cost of \$20,000, is being considered by St. Aidan's Anglican Church. The building, which will be used for Sunday School purposes, will contain recreation and reading rooms and large hall. Rector, Rev. E. A. McIntyre, 15 Cedar Ave.

The York County Law Association (Pres., M. H. Ludwig) has appointed a committee to wait upon the City and County Councils with reference to the erection of a new court house.

Toronto, Ont. (Davisville)

A site for the erection of a new church has been secured by the Davisville Presbyterian Congregation.

Vanguard, Sask.

The Board of Trustees School Dist. No. 3126, has been empowered to borrow \$10,000 for the erection and equipment of a new school building.

Victoria, B.C.

Plans for the "Royal Jubilee" hospital have been prepared by Loring P. Rixford, architect, San Francisco and Victoria, and tenders will be called immediately.

Victoria, B.C.

Tenders addressed to Secretary, R. S. Desrochers, Public Works, Dept., Ottawa, will be received until 4 p.m., Feb. 16, for alterations and additions to the post office. Plans, etc., at office of Wm. Henderson, resident architect, Victoria, Postmaster, Vancouver, and at Dept., Ottawa.

Wainwright, Alta.

The erection of a post office and custom house, at an estimated cost of \$100,000, is being considered by the Public Works Dept., Ottawa.

Walkerville, Ont.

The erection of a public building is under consideration by the Public Works Dept., Ottawa.

Welland, Ont.

Plans have been accepted by the Public School Board for the erection of a public school building on Dennistown St. Estimated cost \$30,000. Architect, A. E. Nicholson, 46 Queen St., St. Catharines.

Windsor, Ont.

Plans for the new school on Wyandotte St. are to be prepared as soon as architect is chosen.

Winnipeg, Man.

The library board will apply for a donation from the Carnegie fund for the erection of two branch libraries. The estimated cost is \$70,000, and the city will contribute \$8,000 for each building. Librarian, J. H. McCarthy.

CONTRACTS AWARDED**Montreal, Que., Maisonneuve**

The following sub-contracts have been awarded by the town council, in connection with the public market. Marble, E. Lepage Marble Co., 734 St. Lawrence (price 90 cents sq. ft.); marble stairs, Mosaic & Tile Co., 483 Bleury (price \$475); copper sheeting, Tremblay & Francoeur, at \$404; painting, Henry Morgan & Co., Beaver Hall Hill. Architect, M. Dufresne, Ontario St., Maisonneuve.

Ottawa, Ont.

A contract for the erection of a new church building for St. Francis D'Assiso Church has been awarded to E. Monette, c/o Capuchin Church, Wellington St.

Toronto, Ont.

The following contracts have been awarded in connection with the club house for St. Pauls Catholic Church. Architect, C. J. Read, 204 Confed. Life Bldg. Mason, J. A. Wickett. Carpentry, M. J. Madden. Plastering, E. J. Currie. Steel, McGregor & McIntyre. Painting, J. W. Mogan. Roofing, W. E. Dillon Co.

Vancouver, B.C.

The contract for immigration building has been awarded by the Public Works Dept., Ottawa, to Geo. Snider & Brethour, Dom. Bldg., \$277,440, who will not be in the market for material for some time yet.

Business Buildings and Industrial Plants**Brampton, Ont.**

The Copeland-Chattenson Co. has communicated with the council asking for certain exemptions and considerations in view of the proposed enlargement of its factory.

Burford, Ont.

R. McCracken, whose flour mill was recently destroyed by fire, will erect a new building at once.

Burlington, Ont.

Herbert Oakes of the Raymond Hotel is considering the addition of another storey to his property.

Edmonton, Alta.

J. W. Lachambre, 1108 Victoria Ave., will invite tenders in the near future for the erection of a six-storey mill-construction warehouse on Fourth St. W.

Goderich, Ont.

Plans have been prepared for addition to the plant of the American Good Roads Machinery Co., at an estimated cost of \$90,000, and tenders will be called in about a week.

Hamilton, Ont.

Messrs. Chadwick Bros., brass manfrs., are negotiating for a factory site on Sherman Ave.

The building of the stores on James St. N. for S. Epstein, 223 Jackson St. W., is postponed indefinitely.

Architects, Stewart & Witton, 7 Hughson St. S., Hamilton, Ont.
(Continued on page 81)

Tenders and For Sale Department

TOWN OF KERROBERT PROVINCE OF SASKATCHEWAN

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer until 2 p.m. on Saturday, February 28th, 1914, for the following works:—

- Contract A.—Laying Watermains (approximately 3 miles).
- Contract B.—Pump House.
- Contract C.—(1) Steel Water Tower.
- Contract C.—(2) Foundation of Water Tower.
- Contract C.—(3) Housing of Steel Water Tower.
- Contract D.—Water Pipes and Specials.
- Contract E.—Valves and Hydrants.
- Contract G.—Pumping Machinery.
- Contract I.—Well and Galleries.

Plans and specifications may be seen at Kerrobert, Sask., or at the offices of the Engineers on and after February 2nd, 1914.

The lowest or any tender not necessarily accepted.

AARON REED, Esq., Mayor.

J. W. LAUMAN, Sec.-Treasurer.

CHIPMAN & POWER, Consulting Engrs.
Winnipeg and Toronto.

4-5



Sealed tenders addressed to the undersigned, and endorsed "Tender for Construction of a 15-inch Hydraulic Self-Propelling Steel Suction Dredge," will be received at this office until 4 p.m. on Tuesday, March 3, 1914, for the construction of a 15-inch Hydraulic Self-Propelling Steel Suction Dredge.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of T. H. Schwitzer, Esq., Mech. Superintendent, Birks Building, Ottawa, Ont.; J. L. Nelson, Esq., Supt. of Dredges, Vancouver, B.C.; J. S. MacLachlan, Esq., District Engineer, Victoria, B.C.; C. C. Worsfold, Esq., District Engineer, New Westminster, B.C.; J. G. Sing, Esq., District Engineer Toronto, Ont.; Collectors of Customs at Kingston and Collingwood, Ont., and A. E. Dubuc, Esq., District Engineer, Montreal, Que.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,

Secretary.

Department of Public Works,
Ottawa, January 20, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—51193.

4-5

Norwich Water Works

Separate tenders will be received for:—

- Cast Iron Water Pipe.
- Hydrants & Valves.
- Excavation & Pipe Laying.
- Turbine Pumps and Motors.
- Elevated Water Tank.
- Driven Well.

For further information apply to

BOWMAN & CONNOR,

Civil Engineers.

Berlin, Ont.

Berlin, Jan. 31, 1914.

5

Tenders for Tools and Machinery

Sealed tenders, marked "Tenders for Tools and Machinery," addressed to the City Commissioners, will be received at the office of the undersigned up to 5 p.m. of Wednesday, February 18, 1914, for the supply of the tool and machinery requirements of the City of Calgary as per specifications.

Specifications and information may be obtained from the offices of the City Engineer or Storekeeper.

A certified cheque payable to the City of Calgary, in the amount of five per cent. of the total amount of bid must accompany each tender. Cheques will be returned to unsuccessful tenderers 80 soon as a contract has been executed.

The lowest or any tender not necessarily accepted.

5

J. M. MILLER, City Clerk.



Sealed tenders addressed to the undersigned, and endorsed "Tender for Pile Wharf and Approaches at Gananoque, Ont.," will be received at this office until 4 p.m., on Monday, February 23, 1914, for the construction of a Pile Wharf and Approaches at the Town of Gananoque, County of Leeds, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the District Engineer's Office, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Gananoque, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,

Secretary.

Department of Public Works,
Ottawa, January 23, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—50087.

4-5

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent., an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929, Contract Record, Toronto. 53-12

GREATER WINNIPEG WATER DISTRICT

To Contractors

Tenders for Railway and Telephone Construction

Sealed tenders, marked "Tender for Railway Construction" or "Tender for Telephone Line Construction," addressed to Commissioners, Greater Winnipeg Water District, 901 Boyd Building, Winnipeg, will be received up to noon of Wednesday, February 11, 1914, for the supply of all tools and material except ties, rails and sundry steel and for the building of grade and laying of track for 85 miles, more or less, of Standard Gauge Railway; also for the supply of tools and materials except poles and for the building of a Telephone Line between Shoal Lake and Transcona.

Information for bidders, specifications and form of tender will be on view and obtainable at office of Commission after Monday, January 26.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,

Chairman of Commissioners.

Winnipeg, Jan. 21, 1914,

4-5

GREATER WINNIPEG WATER DISTRICT

To Supply Men and Manu- facturers

Tenders for Steel Rails and for Track Sundries

Sealed tenders, marked "Tender for Rails and Angle Bars," or "Tender for Track Sundries," addressed to Commissioners of Greater Winnipeg Water District, 901 Boyd Building, Winnipeg, will be received up to noon of Wednesday, February 11, 1914, for

8500 tons of 60 lb. New or Relaying Rails.

400 tons of Angle Bars.

256 tons of Bolts and Spikes.

20 Frogs and Switch Stands.

Information for bidders, specifications and form of tender will be on view and obtainable at office of Commission after Monday, January 26.

The lowest or any tender not necessarily accepted.

S. H. REYNOLDS,

Chairman of Commission.

Winnipeg, Jan. 21, 1914.

4-5

WANTED

Double Drum Hoist about 6½ in. by 8 in.
Engines with Boiler, to carry approximately 100
lbs. steam, for Pile Driving.

HORTON & STODDART,
Owen Sound, Ont.

CITY OF KINGSTON**Tenders for Pavements**

Sealed tenders addressed to the undersigned and endorsed "Tenders for Pavement," will be received up to 3 o'clock p.m., Saturday, February 21st, 1914, for the Excavation, Drainage, Track Drainage, Ballasting, Surfacing and Lining a double track railway and for the paving of same on a concrete base and for eighteen inches outside of the outer rail. Also for the excavation, concrete base, and the paving of the balance of the roadway to the curb, on King Street from Brock Street to the north side of Princess Street and Princess Street from King Street to the west side of Clergy Street.

Plans and specifications for the above works, exclusive of the pavement, may be seen and all other information obtained at the office of the undersigned.

The tenderer will submit with his tender a copy of the specifications of the pavement or wearing surface he proposes to lay, also unit prices for the different works and per square yard of pavement complete.

Approximate quantity of pavement 11,000 square yards.

A marked cheque for five per cent. of the amount of the tender must accompany each bid. The lowest or any tender not necessarily accepted.

R. J. McCLELLAND,
City Engineer

February 2nd, 1914. 5-6



Sealed tenders addressed to the undersigned, and endorsed "Tender for 2nd Extension of New Breakwater, Port Arthur Harbour, Ont.," will be received at this office until 4 p.m. on Monday, March 2, 1914, for the construction of an Extension to what is known as the "New Breakwater" in the Harbour of Port Arthur, Thunder Bay and Rainy River District, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, Ont., Port Arthur, Ont., Post-Office, Montreal, and Post Office, Quebec.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, January 27, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 5-6

Stone Macadam Road

Sealed tenders will be received up to noon on the 2nd day of March, 1914, by the undersigned at Cayuga, Ont., for the construction of twenty-six and one-half miles of stone macadam road in the County of Haldimand. The work will be let in three separate and distinct contracts, not necessarily to the same individual. Tenderers should tender for each contract separately. The work to be done on Contracts Nos. 1 and 2 is situated on the Hamilton and Port Doyer Plank Road, and that on Contract No. 3 is situated on the Talbot Road. Each section has convenient shipping points.

Tenderers are requested to examine the localities of the work and plans and specifications for the same may be seen at the office of the County Engineers, Messrs. Jackson & Kyd, Dunnville, or may be had from them on the payment of \$10.

Lowest or any tender not necessarily accepted.

T. A. SNIDER, K.C., County Clerk,
County of Haldimand, Cayuga, Ont.

5-8

**Notice to Contractors**

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, February 17th, 1914, for the construction of the following sewers, viz.:-

Lappin Avenue and Hallam Avenue,
Storm Overflow Sewer from Lappin Avenue and Emerson Avenue to Hallam Avenue, and Salem Avenue via Lappin Avenue, Dufferin Street and Hallam Avenue.

Danforth Avenue, Main Street to East City limits.

Envelopes containing tenders must be plainly marked on the outside as to contents. Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto. Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer), or, in lieu of said sureties, the bond of a guarantee company, approved of as aforesaid. Conditions relating to tendering as prescribed by city by-law must be strictly complied with. The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, January 29th, 1914. 5

FOR SALE

One

Standard

Gauge

Locomotive

in operating condition

Cylinders 24 in. x 18 in.

The

Jenckes Machine Co.

Limited

SHERBROOKE, QUE.

Tenders for Cement Walks

Tenders will be received by the undersigned, until 6 p.m. Saturday, February 28th, 1914, for the construction of certain Granolithic Walks in the Town of Sudbury.

Approximating 8240.9 lineal feet.

Locations, specifications and forms of tender may be obtained by application to Town Clerk, Sudbury.

Tenders to be sealed and marked "Tenders for Cement Walks."

The lowest or any tender not necessarily accepted.

Marked cheque for five per cent. of value of work to accompany tender.

Granolithic walks other than above are in contemplation for the season of 1914.

Dated at Sudbury this 29th day of January, 1914.

W. J. ROSS, Town Clerk.

**To Bridge Contractors
Second Narrows
Bridge**

Vancouver, B. C.

The Burrard Inlet Tunnel & Bridge Company, 513-514 Carter Cotton Building, Hastings Street, Vancouver, B.C., are prepared to receive tenders for the construction of a Bridge across the Second Narrows of the Burrard Inlet to connect the City of Vancouver and the Municipality of North Vancouver by means of a single line of steam track, two lines of electric car track, two lines of roadway and a footway, together with the necessary approaches thereto, as well as the machinery for working the opening span of the Bridge and other incidental works.

The contract drawings, specifications and schedule of quantities may be seen on and after 21st of January at the offices of the Consulting Engineers, Sir John Wolfe Barry, Lyster & Partners, 2 Queen Anne's Gate, Westminster, England, on and after 19th January at the offices of the company's agents, Messrs. Pringle & Guthrie, Citizen Building, Sparks Street, Ottawa, Ont., and on and after 26th January at the offices of Messrs. Cleveland & Cameron, Civil Engineers, 1001-1010 Rogers Building, Granville and Pender Streets, Vancouver, B.C., between the hours of eleven and four (Saturdays excepted) in each case.

Copies of the drawings, specifications, schedule of quantities and form of tender may be obtained at each of the above offices upon payment of \$100 in Canada and £21 in England, which fee will be returned on receipt of a bona fide tender accompanied by the specification and drawings which are to be returned with the tender.

Tenders endorsed "Tender for Second Narrows Bridge," must be delivered under seal addressed to the Secretary of the Burrard Inlet Tunnel & Bridge Company on or before noon on Wednesday, the 1st day of April, 1914.

The lowest or any tender will not necessarily be accepted.

EUSTACE J. COCKRELL,
Secretary of the Company.

5-7

Wanted Employment

The advertiser is open to take position in connection with a woodworking plant, have had years of experience in high class interior wood finish, estimating, closing contracts, designing and detailing. Correspondence invited. Apply Box 954, Contract Record, Toronto. 5-6

Wanted Employees

WANTED—First-class Architectural Draughtsman. Permanent situation if satisfactory. State terms and experience. Box 937 Contract Record, Toronto. 4-5

WANTED—Machinist, capable of taking charge of small shop. State experience and present salary. Box 453, Contract Record, Toronto. 5-6

Representatives Wanted

The Industrial News Association, Cromwell Buildings, Manchester, Eng., invites communications from those open to represent U. K. manufacturers of engineering, contracting plant, and building materials and equipment. Full particulars are required as to territory covered and facilities for handling sound propositions. Credit and other references are required. 5-6-7

Business Buildings and Industrial Plants

(Continued from page 79)

son St. S., are inviting tenders for alterations to the store of A. M. Souter & Co., King St. W.

The Mercantile Trust Co. is negotiating for the purchase of the 6 storey building Hughson and Main Sts., and propose adding 2 or 3 storeys.

Ingersoll, Ont.

The Northway Co., Ltd., Thames St., has under consideration certain alterations and improvements to their store on Thames street.

The erection of a fertilizer factory at an estimated cost of \$10,000 is contemplated by Wm. Stone, Sons & Co., Ltd., Oxford street.

London, Ont.

A. W. Brown, 374 Belleville Ave., Newark, N.J., has plans in progress for the erection of a \$100,000 theatre for the Canadian Theatres Company.

Montreal, Que.

Nobbs & Hyde and J. R. Gardiner, Beaver Hall Hill, have plans in hand for the erection of an office building on Dorchester street west, for the Liverpool, London & Globe Assurance Co.

New plans are in progress for the erection of a 4-storey paint factory for the Martin-Senour Co., Ltd. W. B. McLean, architect, 204 St. James St., expects to call tenders about March 1st.

Architect is preparing plans and will probably call tenders shortly for remodelling stores for W. E. Doran, 189 Bleury street.

H. C. Jones, architect, Stanley street, has plans drawn for the alteration of 187 Bleury St. into stores, etc., as soon as leases expire May 1st. The work is estimated to cost \$50,000, and tenders will be invited in due course.

Moncton, N.B.

The Victoria Club, Pres., W. K. Gross, is interested in the projected construction of an arena.

Montreal, Que.

A permit for alterations to their factory at a cost of \$5,000 has been granted to Beaudin Besner & Demers, 1215 St. Denis.

Plans are in progress for stores on St. Catherine W., for Jaeger's Sanitary Woolen System Co., Ltd., 316 St. Catherine W., and tenders will be called about March 1st.

Tenders for alterations and addition to hotel for Mrs. Martin, 109 Windsor St., will close Feb. 7th. Architect, D. J. Crighton, Jacobs Bldg., St. Catherine W.

C. E. Deakin, 41 Mayor St., is receiving tenders for roofing, marble, architectural iron, plumbing, heating, window

fronts and electrical fittings, in connection with the erection of stores on St. Catherine St. W., for the Dominion Square Land Co.

Montreal, Que., Westmount

S. Comber, Greene Ave. and St. Catherine St., expects to call tenders about March 1st for the erection of stables for D. Harrison. Estimated cost \$50,000.

Montreal, Que., Maisonneuve

Mr. A. Michaud, Quebec Bank Bldg., Montreal, is considering the erection of stores and manufacturing plant on Ontario St., at an estimated cost of \$50,000.

Montreal, Que., St. Henry

Tender for the erection of a picture theatre on Notre Dame St., for Messrs. Tabot, Cousin & Lawand, are invited by Audet & Charbonneau, 15 St. James St.

Sudbury, Ont.

Wm. H. Owens, architect, is about to prepare plans for A. Silverman, Elm St., for the erection of a \$30,000 business block on Durham St.

Wm. H. Owens, architect, will shortly draw plans for the erection of a store and apartment building on Cedar street for Sam Jessop.

W. H. Owens, architect, has plans in progress for the erection of a business block, dance hall and moving picture theatre, near Durham St., at an estimated cost of \$40,000, for Messrs. H. Young, Mackey, Coulson & Bisset. The specification includes 2 storeys and basement, 45 x 120, reinforced concrete, tapestry brick construction, and reinforced concrete foundation.

Sketches have been drawn by Wm. H. Owens for the erection of store and apartment on Cedar street, for Wilson & Greenwood at a cost of \$18,000.

Sudbury, Ont., Elgin

W. Workman has plans in progress for stores and offices for Rothchild Bros., at a estimated cost of \$30,000. The specification includes two storeys and basement, 150 x 50, brick and steel construction, concrete foundation, waterproofed, comp. paper, felt and gravel roofing, electric lighting, hot water heating.

St. John, N.B.

The New Brunswick Packing Co., Ltd., recently incorporated with a capital of \$99,000, has obtained option on a site at Coldbrook, near St. John, and will erect a plant thereon.

St. Catharines, Ont.

The by-law to grant the Consumers Rubber Company a free site and exemptions was defeated by the ratepayers on January 28.

Swift Current, Sask.

The International Harvester Co., Chicago, Ill., will start work on the erection of a warehouse here in the spring.

Truro, N.S.

Plans are being prepared by E. D. Vernon, architect, Dominion St., for the erection of a new hall for the I.O.O.F., at an estimated cost of \$25,000.

Toronto, Ont.

The Dominion Bank has purchased a site on the south-west corner of McCaul and Andersons Sts. for the erection of a branch bank.

Vancouver, B.C.

A permit has been granted to Sam & Lung Kee for the erection of a theatre

on Keefer and Columbia Sts., at a cost of \$25,000.

The work on the Royal Bank office building at the corner of Granville and Hastings Sts. will not likely start this year.

Windsor, Ont.

Tenders for the erection of a factory on Pitt St. E., for J. T. Wing & Co., will be received by James C. Pennington, architect, from Feb. 1st until Feb. 12th. The specification includes three storeys, 100 x 100, steel and brick construction, concrete foundation, waterproofed, felt and gravel roofing.

Winnipeg, Man.

Major Schurman, 32 Canada Life Bldg., will probably start work in the spring, on the erection of an office building on Portage Ave. E.

The Winnipeg Tanning Co., Ltd., 382 Nairn Ave., will rebuild the factory recently damaged by fire.

The Gould Hotel, Jarvis and Derby Sts., is to be completely remodelled.

A. Wolfson, 803 Confederation Life Bldg., will probably erect a \$10,000 store building on Vaughan street.

Plans have been drawn for a large store and office block on Portage Ave., for D. S. Curry, London, Eng. Private tenders will be called shortly by J. D. Atcheson & Co., architects, Trust and Loan Bldg. The specification includes "U" shaped building to contain 21 stores, Gothic architecture. Five storeys, concrete caissons, terra cotta, fireproof, hollow tile, steel and pressed brick construction.

McDonagh & Shea, Coloney St., are considering the addition of 1-storey to their stock house at an estimated cost of \$20,000.

CONTRACTS AWARDED

Montreal, Que.

The contract for the alterations to store and offices on St. Antoine St., have been awarded by the British Realty Co., to R. Mauson, 381 Victoria St.

The contract for heating and plumbing at the St. James St. branch of the Bank of Toronto has been awarded to Conroy Bros., 291 Centre street.

The following sub-contracts have been awarded in connection with the erection of stores, etc., on Peel and St. Catherine Sts., for the Crown Trust Co., 145 St. James St. Revolving Door, Dom. Revolving Door Co., 10 Phillips Place; mill work, A. Allard, Girard St., Viauville, Montreal; electrical fittings, Westmount Plumbing and Heating Co., 4278 St. Catherine street.

Toronto, Ont.

The contract for the erection of a factory on Clinton St., has been awarded by Canadian Seamless Wire Co., 88 Ter-auley St., to J. B. Baker, 9 St. Enoch Sq. W.

Residences

Copper Cliff, Ont.

It is probable that the Canadian Copper Company will not call for tenders for the erection of the houses at No. 3 Frude Mine.

Hamilton, Ont.

Sub-contracts connected with the erection of the residences on Inglewood

(Continued on page 84)

“Inglis” Corliss Engines

are known above all others as being pre-eminently “Engines of Quality,” Economical, Durable and Reliable and can be depended upon to give the same good results twenty years from now.

We build them Single, Tandem, Compound and Triple, for heavy or light duty. Remember our Fifty year reputation is back of every “INGLIS” engine. Specifications and prices upon request.

The John Inglis Company

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14 Strachan Ave.,

Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Drive for S. McPhie and L. Donaldson, 701 Bank of Hamilton Bldg., have been awarded to Carding & Cheyne, 404 Herkimer street, for plastering, and Gooddale & Laidlaw, Hunter St. E., for painting.

London, Ont.

Hyatt Bros., Egerton St., East London, are drawing plans for twelve residences, total cost of which will be \$30,000.

Montreal, Que.

Permit has been granted to Mathias Larose, 2240 Chateaubriand, for the erection of 9 flats, at an estimated cost of \$6,500.

Toronto, Ont.

Plans have been drawn for 3 attached stores and residences on Gerrard St., for R. Luxton, 583 Pape Ave.

Plans have been drawn for one detached residence, \$5,000, on Keele St., for A. J. Peppiatt, 81 Hilton Ave.

Power Plants, Electricity and Telephones

Belleville, Ont.

The city council has under consideration the installation of a new street lighting system.

Carleton Place, Ont.

Tenders for electric wiring, etc., at the public building, addressed to R. C. Desrochers, Sec. Public Works Dept., Ottawa, will be received until Feb. 9th. Plans, etc., with Caretaker Public Bldg., Carleton Place and at Dept., Ottawa.

Kisbey, Sask.

The South Kisbey Rural Telephone Co. has been authorized to borrow \$6,500 for the construction of a telephone system.

Hamilton, Ont.

Tenders will shortly be called by the City Council (Hydro-electric Dept.) for 500 ornamental standards and lights.

Hull, Que.

A conference is to be held to consider the proposed extension of the electric railway system to Gatineau Point.

Moose Jaw, Sask.

Tenders addressed to R. C. Desrochers, Sec. Public Works Dept., Ottawa, will be received until Feb. 23rd for the installation of an electric elevator at the public building. Specifications at office of W. Tilson, Clerk of Works, Moose Jaw, H. E. Matthews, Res. Architect, Lindsay Bldg., Winnipeg, and at Dept., Ottawa.

Niagara Falls, Ont.

The engineer-in-charge, F. J. Anderson, recommends that River Road be lighted for 2 miles by incandescent lamps on iron stands, alternative arc lamps on iron standards.

Ottawa, Ont.

W. S. Edwards & Co., Sussex St., are applying to Government to have their charter amended so that they may manufacture electricity for the purpose of heat, light and power. Power will be developed at Rideau River, at "Rideau Twin Falls."

Pt. Stanley, Ont.

The Public Works Dept., Ottawa, has under consideration the installation of new lights for piers and Govt. premises

Engineer, H. J. Lamb, Curry Bldg., Ouellette Ave., Windsor.

Regina, Sask.

The city council has under consideration the construction of an additional 10 miles of street railway, at an estimated cost of \$250,000.

Sudbury, Ont.

The town council propooses to install ornamental luminous lighting on two streets, and will purchase 139 60-c.p. tungsten lamps with 4-ft. wrought iron scroll brackets. Extensions to the power house are also contemplated.

Simpson, Sask.

The Simpson Rural Telephone Co., Ltd., will probably erect a telephone exchange at an estimated cost of \$10,000.

Toronto, Ont.

The Toronto Street Railway Co. are planning to erect 2 new barns.

Winnipeg, Man.

The time for the receipt of tenders for the towers on the new transmission line between Winnipeg and Point du Bois has been extended to Feb. 5th.

Wolseley, Sask.

The Durham Rural Telephone Co. has been authorized to borrow \$4,500 for the construction of a telephone system.

Welland, Ont.

The Niagara, Welland & Lake Erie Railway decided at their annual meeting to construct a line from Welland to Port Colborne, Fort Erie and Niagara Falls. The company also plan to start extensions at once on North Main St. to Parkway Heights and to Rosedale.

EXCEPTIONAL OPPORTUNITIES

ARE NOW OFFERED

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Come Early, or Failing That, Write Us.

A FEW ITEMS OF OUR STOCK

Boilers (Horizontal)
Boilers (Vertical)
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Structural Steel

Bolts and Rivets
Tool and Machine Steel
Tanks (all purposes)
Plates (all grades)

Patterns, various
Bars (Iron and Steel)
Smoke Stacks
Tobin Bronze

MACHINERY EN BLOC OR UNITS, Etc., Etc.

INTERNATIONAL MARINE SIGNAL CO., LIMITED

Ottawa, Ont.

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In a month from now our new Steel Sash Factory in Peterboro will be running. We've had to build in Canada because the demand for HOPE SASH has made it necessary.

The factory which we have erected is without doubt the largest in Canada being used entirely in the manufacture of Steel Sash, as well as being the most Modern and Best Equipped Steel Sash plant in America.

Every piece of machinery that is being used has been specially designed and made for us. This was done to insure the making of the very highest type of Steel Sash in the least number of operations, thus securing efficiency and lower cost.

We are now ready to estimate on your contracts. Get in touch with us. Let us have your plans and we will prepare details for you showing how HOPE SASH can be used to the best advantage. We can give you prompt deliveries too, because it's

Now to be made in Canada.

Our handsome book explaining all about Hope Sash and containing beautiful illustration is yours for the asking. Simply address Dept. S.

HENRY HOPE & SONS OF CANADA, LIMITED

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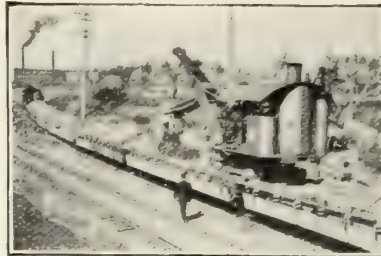
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The only Paint that will adhere for years to Galvanized Iron roofing, siding, cornices, etc.

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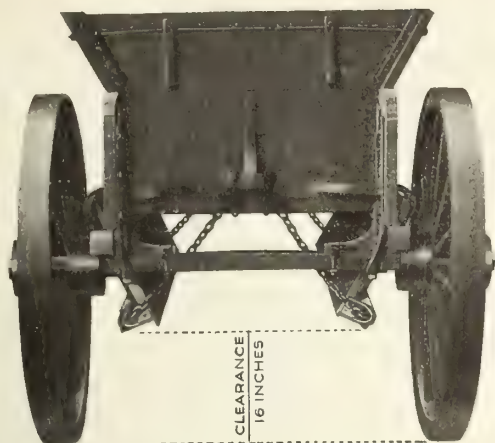
The only Paint that will beautify and make walls, ceilings, tile, concrete, brick and stone walls moist-proof and sanitary. Produced with strong luster finish or semi-luster, or flat finish. Can be frequently washed without injury.

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when you install STANDARD Rubber Insulated Wire in that building of yours. Its guarantee of safety consists of many years of unusually successful and dependable service and in the fact that it is specified and used by architects, engineers and contractors of many buildings of international importance, one of which is shown below.

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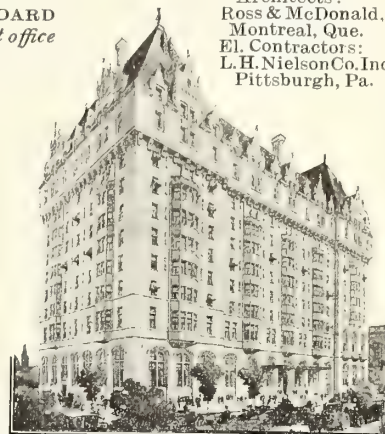
stands for maximum economy and durability. It exceeds N. E. C. requirements to a degree that entitles it to be considered as a separate and higher standard of excellence.

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El. Contractors:
L.H. Nielson Co., Inc.
Pittsburgh, Pa.



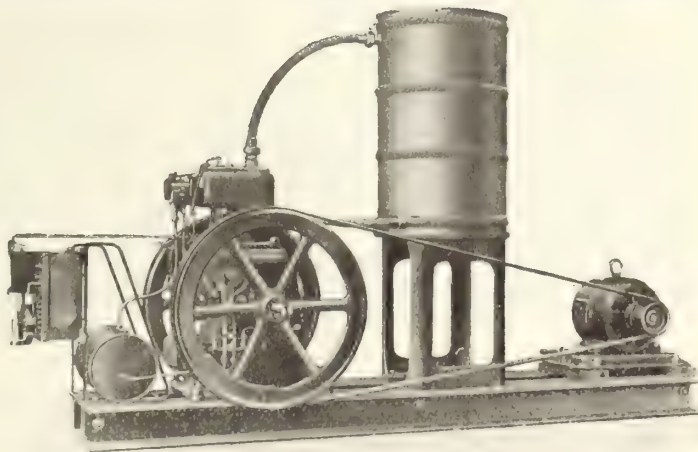
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Any voltage or capacity.

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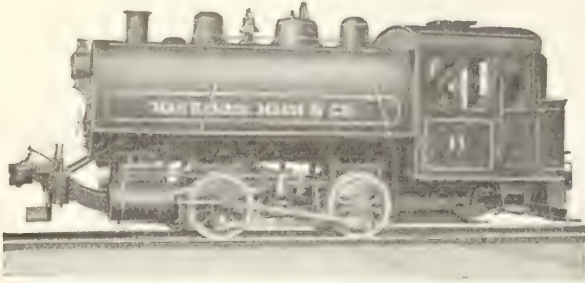
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TORONTO

St. John, N.B.

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41 ft.	18 in. x 20 in.	33 ft.	15 in. x 15 in.	51 ft.	18 in. x 19 in.	31 ft.	13 in. x 13 in.
40 ft.	19 in. x 20 in.	43 ft.	18 in. x 19 in.	48 ft.	15 in. x 16 in.	31 ft.	14 in. x 16 in.
32 ft.	12 in. x 15 in.	60 ft.	14 in. x 15 in.	44 ft.	14 in. x 15 in.	35 ft.	14 in. x 15 in.
24 ft.	15 in. x 16 in.	44 ft.	18 in. x 18 in.	43 ft.	18 in. x 19 in.	39 ft.	18 in. x 18 in.
34 ft.	12 in. x 14 in.	43 ft.	16 in. x 16 in.	34 ft.	13 in. x 13 in.	41 ft.	17 in. x 18 in.
25 ft.	14 in. x 14 in.	38 ft.	13 in. x 15 in.	30 ft.	14 in. x 15 in.	42 ft.	16 in. x 18 in.
28 ft.	14 in. x 13 in.	41 ft.	12 in. x 13 in.	21 ft.	15 in. x 16 in.	41 ft.	14 in. x 15 in.
32 ft.	12 in. x 14 in.	37 ft.	13 in. x 14 in.	23 ft.	19 in. x 20 in.	38 ft.	13 in. x 14 in.
28 ft.	16 in. x 16 in.	43 ft.	16 in. x 16 in.	29 ft.	17 in. x 19 in.	27 ft.	14 in. x 17 in.
29 ft.	16 in. x 16 in.	47 ft.	16 in. x 17 in.	34 ft.	14 in. x 15 in.	44 ft.	14 in. x 15 in.
31 ft.	14 in. x 13 in.	43 ft.	15 in. x 16 in.	35 ft.	14 in. x 17 in.	40 ft.	13 in. x 13 in.
33 ft.	13 in. x 14 in.	39 ft.	14 in. x 14 in.	35 ft.	15 in. x 15 in.	41 ft.	13 in. x 14 in.
33 ft.	13 in. x 14 in.	41 ft.	13 in. x 15 in.	31 ft.	12 in. x 13 in.	39 ft.	13 in. x 13 in.

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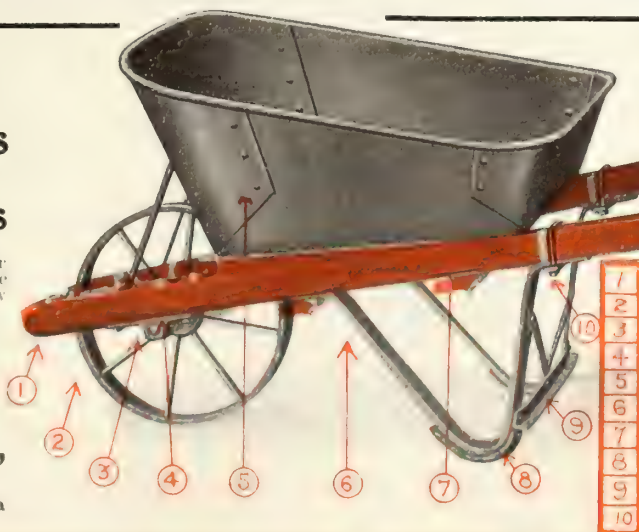
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The
Test

Forged Steel Wheel Guard
Self-Lubricating Wheel
Cold Rolled Steel Shaft
Malleable Wheel Supports
Double Cornered Riveted Trays
Heavy Channel Steel Legs
Tested Clear Maple Handles
Extra Heavy Leg Shoes
Riveted Leg Braces
Patented Handle Clamps

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Hand or Power



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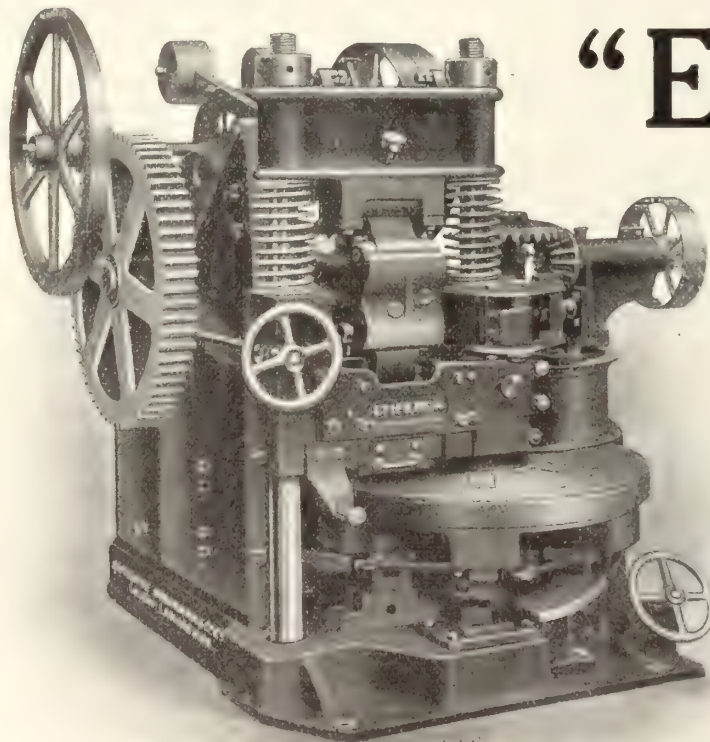
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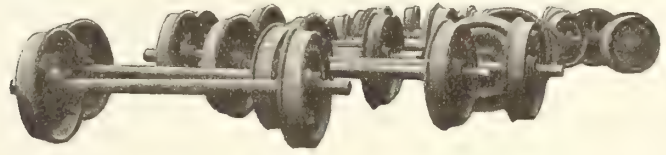
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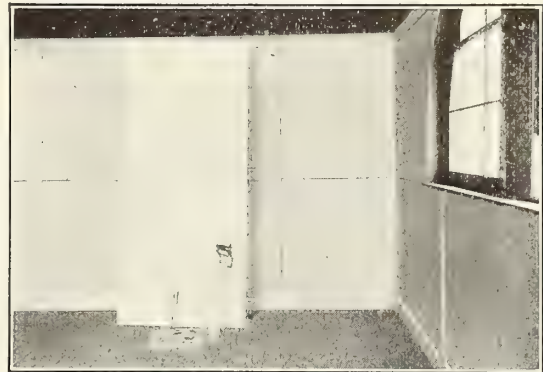


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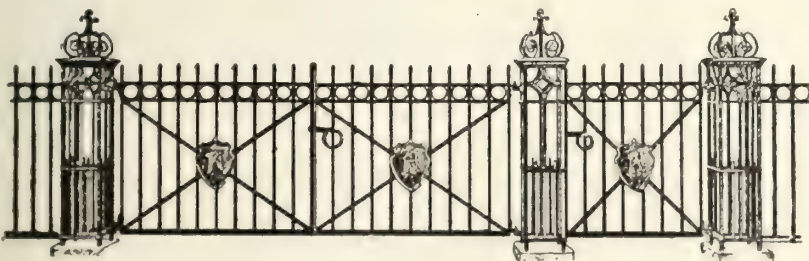
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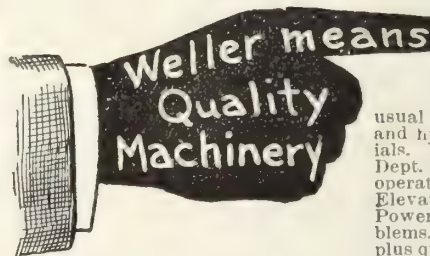
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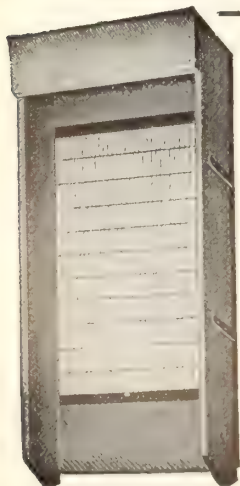
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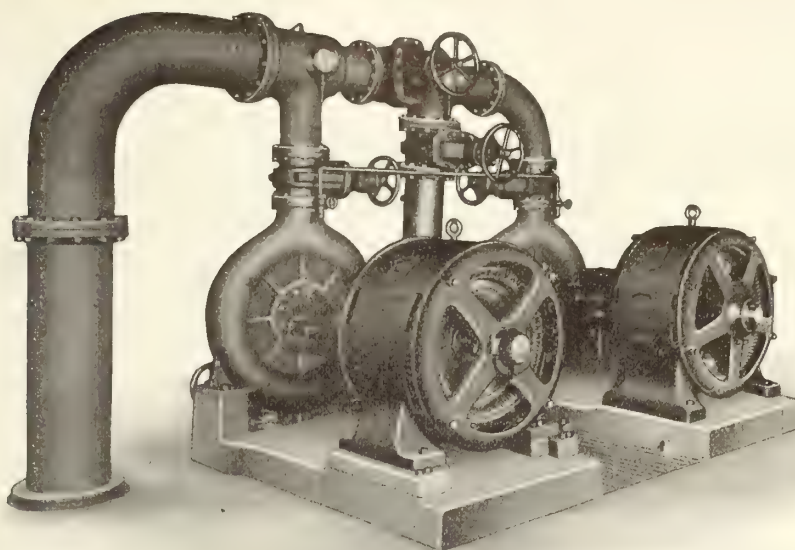
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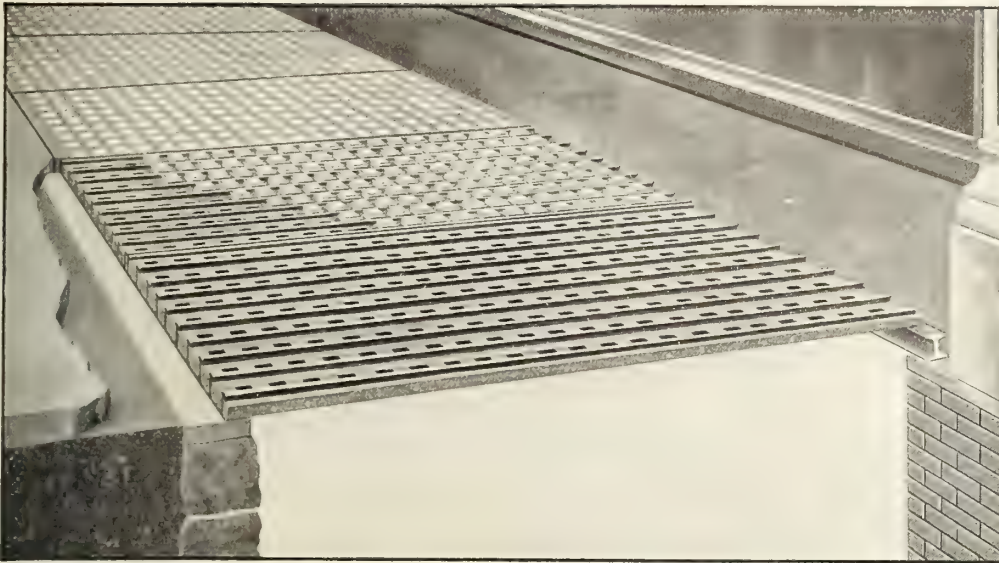
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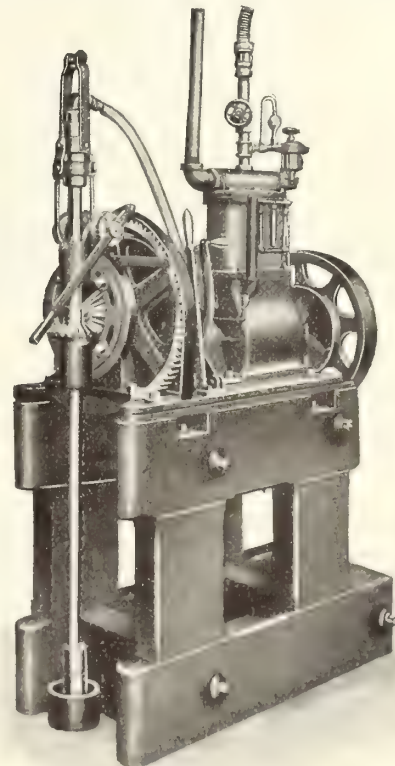
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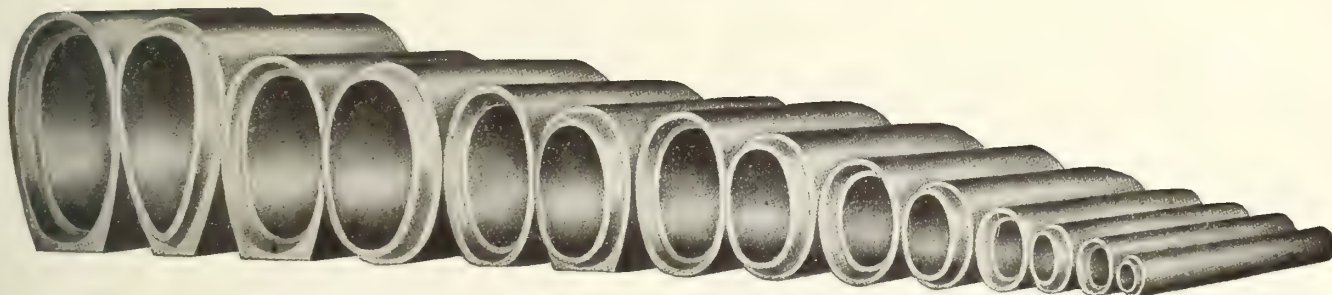
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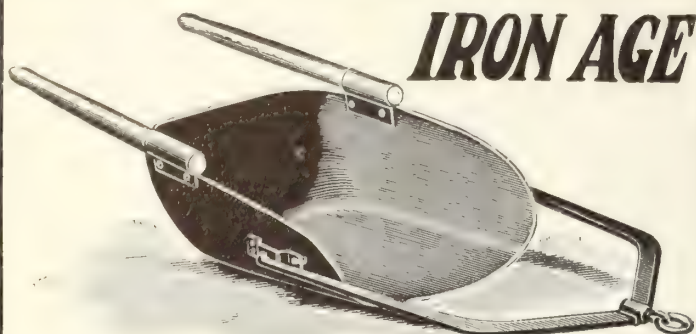
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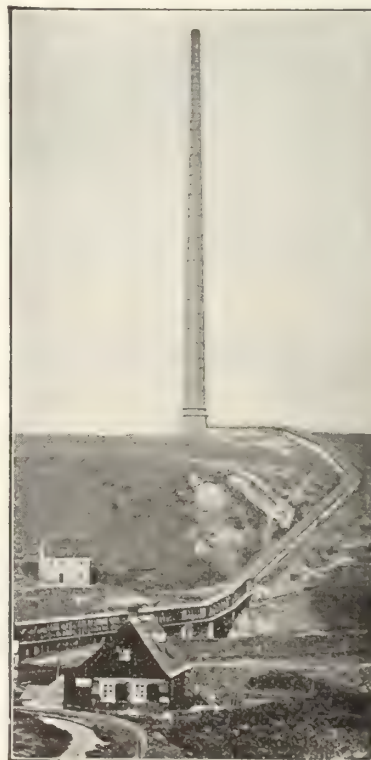
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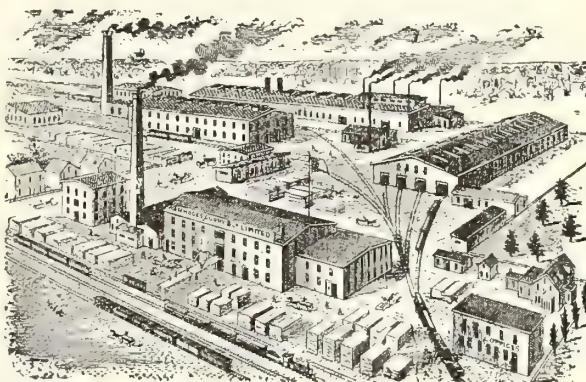
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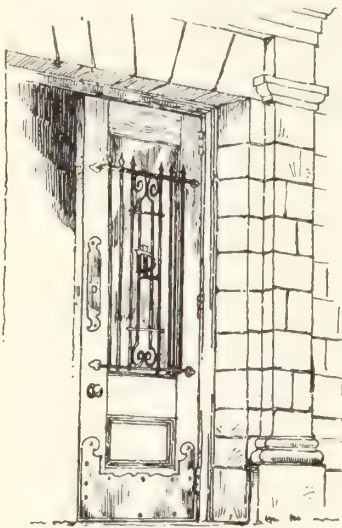
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**Wrought
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has a 25% factor of safety over the same size of any other make. A swell of 25% added material at the weld makes that point the strongest part of the link.



Guaranteed to pull stiff before breaking and not to break at weld.

Sizes 3/16" to 3/4" inclusive.

Made in Canada by

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

The Galt Stove & Furnace Co., Limited, GALT, ONT., CAN.

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Large stock I Beams, Channels, Angles, Tees, Zees, and Plates always on hand.

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Shipments can be made from any of our three plants. Rail shipments of Scotia bricks are made from the Elmsdale works while Beaver and Acadia brands may be shipped by rail or water from Pugwash works or Annapolis works.

The three brands are identical in size and quality.

May we send you prices, etc?

Nova Scotia Clay Works, Ltd.

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WINDOW
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BENDERS
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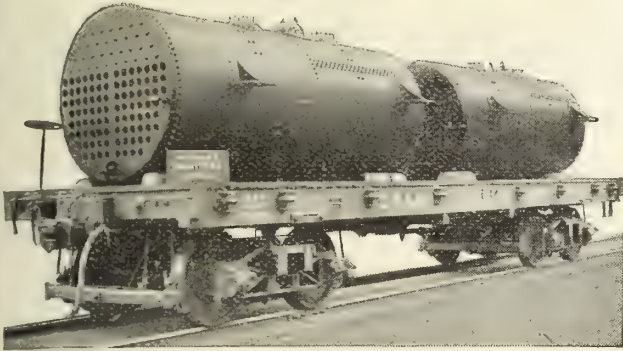
THE TORONTO PLATE GLASS IMPORTING COMPANY, LIMITED

Plate, Window, Figured, Stained, Wired, Bent, Mirror
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WATEROUS RETURN TUBULAR BOILERS



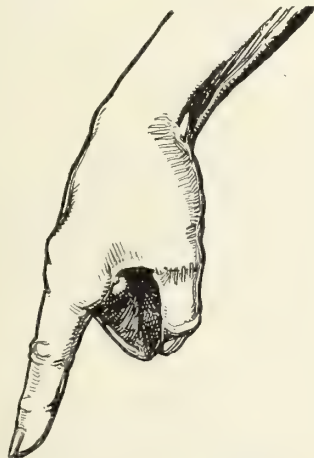
The Return Tubular Boiler is the best all-round boiler for continuous, seven-days-in-the-week, industrial service. Waterous boilers are the best built boilers of this type.

They are economical of fuel — carry a large reserve steam pressure for use in emergencies — will use hard and dirty water and are easily handled and readily cleaned.

We build all sizes up to 250 H. P. and can supply most of them direct from stock.

You will find Waterous Boilers in the largest Industrial and Municipal power plants in Canada.

They are used where service counts.

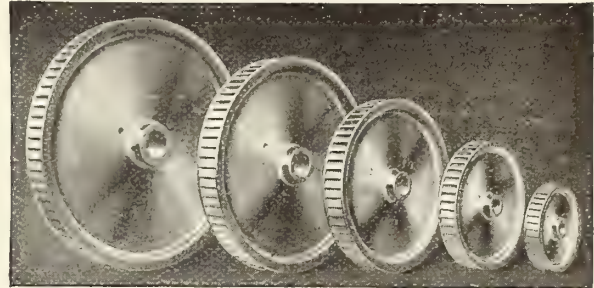


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Canadian Pacific Railway, Calgary, Alta.,	2-60" x 14'
Okanagan Sawmills, Enderby, B. C.,	2-66" x 14'
Lake Superior Iron and Steel Co., Sault Ste. Marie	5-72" x 18'
Corporation of Orangeville	1-54" x 14'
Dominion Cannery, Simcoe	3-72" x 18'
Grand Trunk R.R., Montreal	2-72" x 18'
Steel Company, Limited, Hamilton	2-72" x 18'
Dunlop Tire & Rubber Goods Co., Toronto	1-72" x 18'
Imperial Oil Co., Limited, Sarnia	5-72" x 18'
Canadian Westinghouse Co., Hamilton	2-48" x 14'

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Works Company, Limited**
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The Rotor with the Solid Buckets



Upon the design and construction of the rotor depends
the ultimate success or failure of the Steam Turbine.

Notice the above illustration of the Sturtevant Steam Turbine rotors. See the solid milled-in buckets with their straight edges (not found in any other turbine). There is no chance there for broken buckets, wrecked turbines or reduced efficiency through steam leakage from one bucket to the other.

These buckets of

Sturtevant
(REG. U. S. PAT. OFF.)

Steam Turbines

are milled into a solid steel forging of a chemical composition that resists corrosion or pitting. The rotors are then given a perfect static balance, which, because of their symmetry means a practically perfect dynamic balance. They are fastened to the shaft by a ground taper fit, and the entire rotor (not merely the buckets) is carefully polished to minimize rotation losses.

This is only one detail in the design and construction of this highly efficient turbine. Others are described in our catalog 210-Z.

Remember that STURTEVANT Turbines are adapted to driving any apparatus at its most efficient speed.

**We would be glad to write you fully as to how
this turbine would meet your requirements.**

**B. F. Sturtevant Company
of Canada, Limited**
Galt, Ontario

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919 New Birks Building, Montreal

Current Prices of Building and Engineering Materials

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	\$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Brick	13 00
Grey Stock Brick	12 00
Wire cut brick for foundation work	11 00
Porous terra cotta brick	15 00
No. 1 enamelled brick, all colors, from	\$80 00 to \$150 00
Sand-Lime Brick (King Edward Siding).	8 10

LUMBER (Building Material)

Hemlock Lumber—	
2 in. x 4 to 2 in. x 12 in., 8 to 14 ft.	\$26 00
2 x 4 to 2 x 12, 16 ft.	26 00
2 x 4 to 2 x 12, 18 ft.	29 00
1 in. Hemlock, No. 1	25 00
No. 1 Hemlock Decking	25 00
No. 2 Hemlock dimension and 1-in.	19 00
Pine—	
1 in. common pine 8 to 12 in. wide rough	26 00
2 in. white pine Bill stock	29 00
3/4 x 8 and 10 in. pine shelving	36 00
3/4 x 12 in. pine shelving	45 00
No. 1 white pine flooring	33 00
No. 1 spruce flooring	28 00
No. 1 pine decking D2S	30 00
Spruce Decking	28 00
No. 1 pine V. or headed sheeting	36 00
No. 2 pine V. or beaded sheeting	32 00
Pine trim for paint finish—	
4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75
Shingles—	
XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00
Cedar Posts—Fence—	
5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50
Dimension Timber up to 32 feet:	
8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	\$3 25	\$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	\$3 50	\$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 65 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 70 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net\$1.85
No. 4 1/2 Fuller's net\$2.35
Square head brass cocks, 65 and 5 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6 3/4 cents per lb.; traps and bends, 40 per cent.; pig lead, 6 1/4 cents per lb.

Iron Pipe

Size (per 100 ft.)	Black	Galvanized
1/4 inch	\$2.16	3/4 inch \$3.06
3/8 "	2.16	3/8 " 3.06
1/2 "	2.64	1/2 " 3.57
3/4 "	3.05	3/4 " 4.20
1 "	4.51	1 " 6.21

1 1/4 "	6.10	1 1/4 "	8.40
1 1/2 "	7.29	1 1/2 "	10.04
2 "	9.81	2 "	13.51
2 1/2 "	16.80	2 1/2 "	21.65
3 "	20.66	3 "	28.31

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67 1/2; nipples, 4-inch diameter and under, 75 and 10; nipples, 4 1/2-inch and up, 70 and 10; malleable lipped unions, 67 1/2 per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 and 10 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in.	25c ft.	15-in.	1.40 ft.
6-in.	40c ft.	18-in.	1.90 ft.
9-in.	70c ft.	20-in.	2.25 ft.
12-in.	1.00 ft.	24-in.	3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.
Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.
Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; 3/4-inch, \$1.45.
Burnt River rubble stone delivered, \$16 to \$17 per toise.
Plain steel bars, \$2.25.
Square twisted bars, 3/4 to 1 1/4, \$2.35.
Malleable fittings — Canadian discount, 45 and 42 1/2 per cent.
Free stone delivered, \$15 to \$18 per toise.
Brown coursing stone, delivered, \$3.75 per yard.
Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.
Sand, for cement or brick work, \$1.20 a cubic yard, f.o.b. Toronto, C. P. R. siding.
Sand, for cement or brick work, 85c to \$1.00 a cubic yard, f.o.b. Toronto, G. T. R. sidings.
Brown sills and heads, in the rough, delivered, 40 cents per foot.
Rubble stone in car lots, \$1.30 per ton.
Steel channels and beams, angles and plates, \$2.55 to \$2.90 per 100 pounds, delivered f.o.b. Toronto.
Hard Wall Plaster, unsanded, from \$8.00 to \$8.50, bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.
Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.
Plaster of Paris, Anchor and Crown Brands, \$1.50 bbl.
Manilla Rope, best, per pound, 12 1/2 cents.

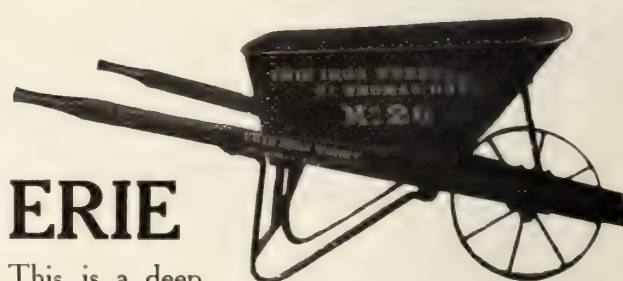
PAINTS AND OILS

Pure White Lead, ground in oil, \$8.75 per 100 lbs.
Boiled Linseed Oil in bbls., 65c per gal. of 9 lbs.
Raw Linseed Oil, in bbls., 62c per gallon.
Pure Red Lead, dry, \$7.00 to \$8.00 per 100 lbs.
Putty, pure linseed oil, in bulk, bbls., 3 3/4c.
Putty, pure linseed oil, in 25-lb. tins, 4c.
Turpentine in bbls., 66c.



All Steel

"Erie" Barrow No. 23 has a solid welded steel tray of uniform thickness and great strength. The handles are given an extra bend to put tray load more over wheel.



ERIE

This is a deep barrow for carrying concrete or other sloppy material. Wheel guarded and forward dump.

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RAILS**BILLETS****Concrete Reinforcement Bars**

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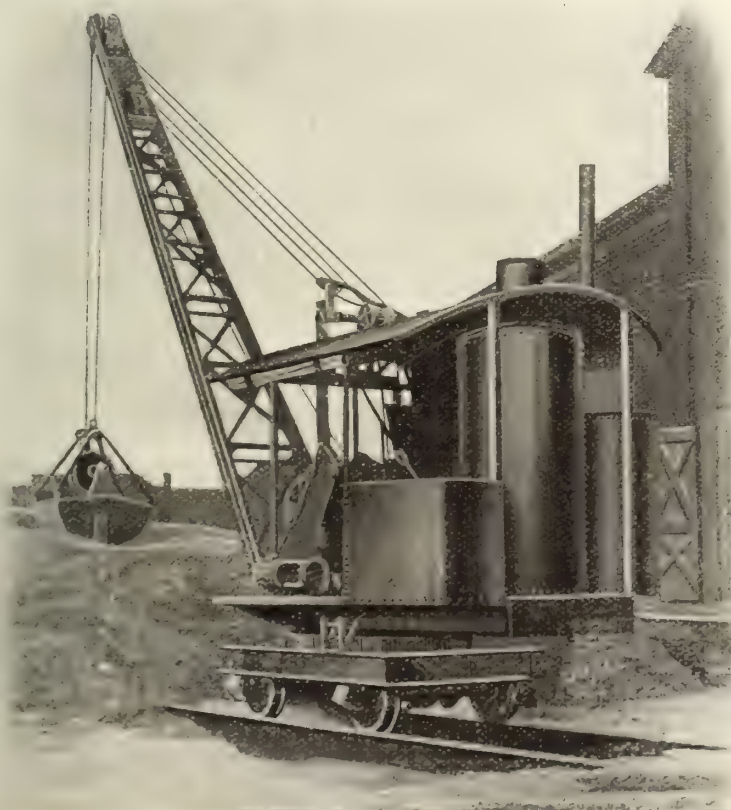
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When equipped with a Clam Shell Bucket
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Will also do your switching and shunting.

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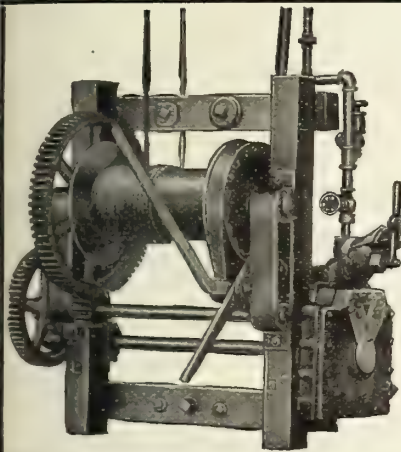
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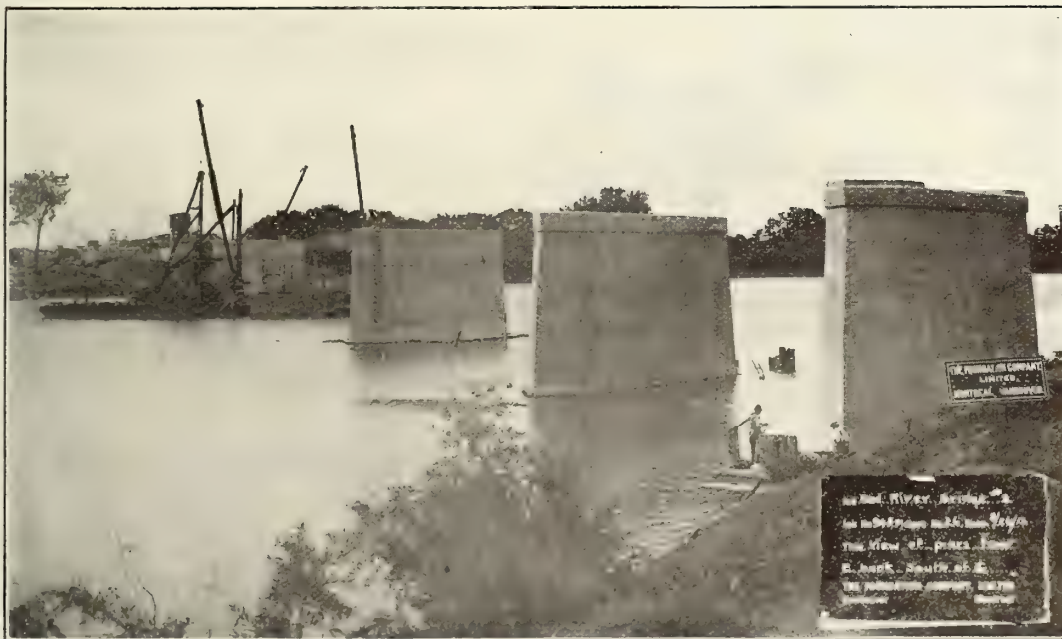
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"TAMCO" Crushed Stone in
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April-11-1913



August-26-1913

THE FOUNDATION COMPANY, LIMITED
MONTREAL **VANCOUVER**

"Buffalo"

Punches Shears and Drills

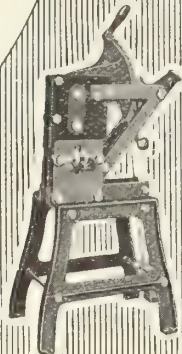
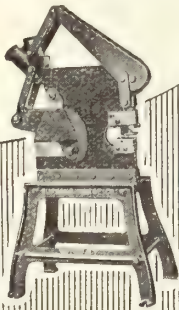
Among our recent designs is the Bar Cutter No. 10 for cutting concrete reinforced bars—twisted, round or any other shape. It cuts bars up to 1½" thick and, due to its steel frame, its **weight is only half** that of a cast iron machine of the same capacity. Ask for catalog of Steel Punches, Shears and Drills No. 145.

Canadian Buffalo Forge Co.

MONTREAL Limited

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"Built to Last"

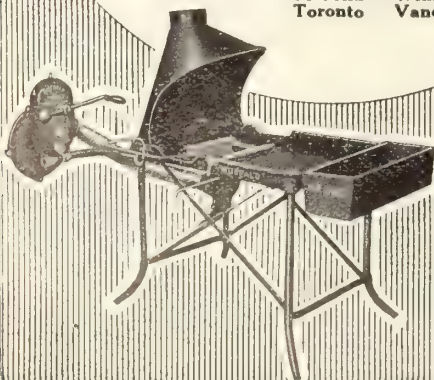
is the slogan of our **1912 Rivet Forge**. The repair cost by this design is guaranteed to be **actually cut in two**, compared with any other forge now in the market. A bridge company using a large number of forges writes us regarding it: "The operator claims it runs easier and heats more rivets in less time than any forge he has ever used." Let us send you one on free trial. Fifty other styles, for light and heavy work.

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Warehouse Space To Let

**5 Floors of This New
Building, For Office
and Warehouse Use.**

Adelaide St. W., Toronto

When completed this will be the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

Centrally situated
Light on four sides
Passenger and freight elevator
Vaults
Low insurance
One block from four car lines
Floor area, 6,300 sq. feet, each floor.

For further particulars ask

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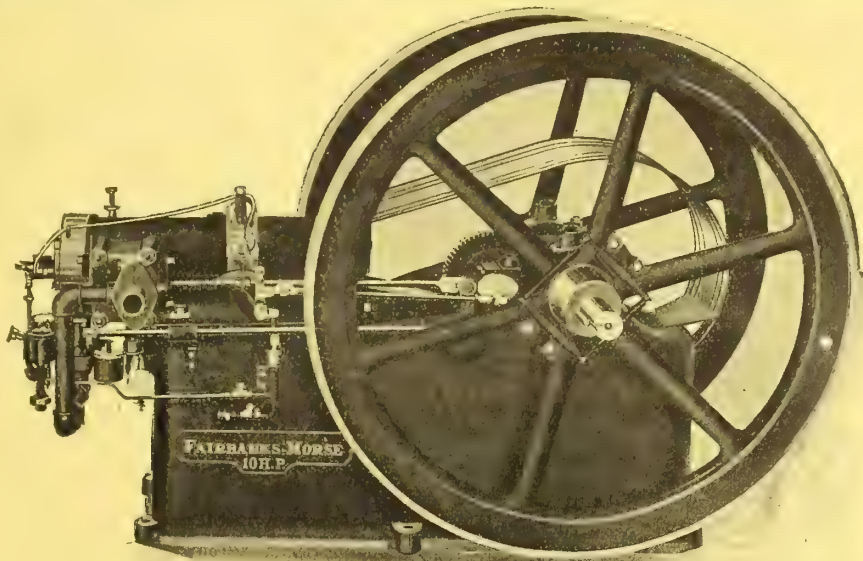
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Advantages of the Oil Engine

As gasoline is steadily rising in price, the cost of operating a gas engine is becoming a serious problem. You do not have to use gasoline, however. You can use oil and greatly reduce your power cost.

Fairbanks - Morse Oil Engines will operate successfully on 72 per cent. of the oils distilled from the average crude.

Aside from its low fuel cost, the oil engine has many striking advantages over any other type of engine. It is the ideal engine for contractors and mining service, because of its portability; cleanliness; automatic operation, requiring no skilled attendants; no expense when not running; no water required except for the cooling tank; absolute safety, no danger from fire, and thorough reliability. Our oil engines are equipped with the famous Bosch Magneto. The type shown here is made in sizes of from 8 h.p. to 25 h.p. We build oil engines in all the common sizes of from 2 h.p. up to 200 h.p. Ask for catalogue 52.



The Canadian Fairbanks-Morse Co., Limited

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WINNIPEG

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12



Across Canada with the

Imperial Wire & Cable Company, Limited

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First of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows the

The Ritz-Carlton Hotel, Montreal

Architects—Warren & Wetmore—New York.

Engineers—Mailloux & Knox—New York.

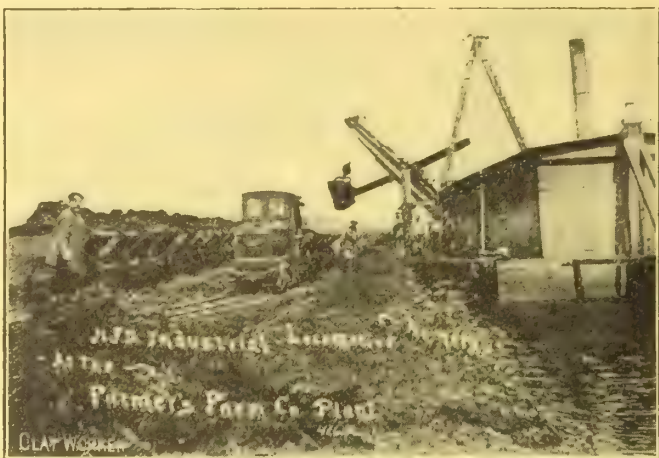
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Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

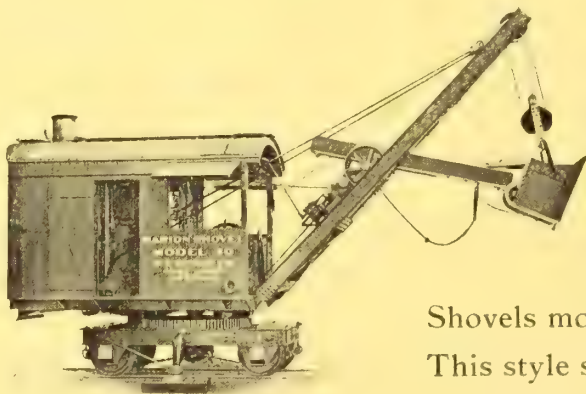
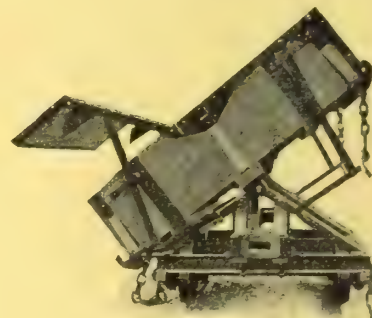
Brickyards, Quarries,
Mines, Contractors, etc.

All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.



“MARION” STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
5/8 - 1 and 1 1/2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks.
This style shovel is specially adapted for Brickyards—Mines
—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

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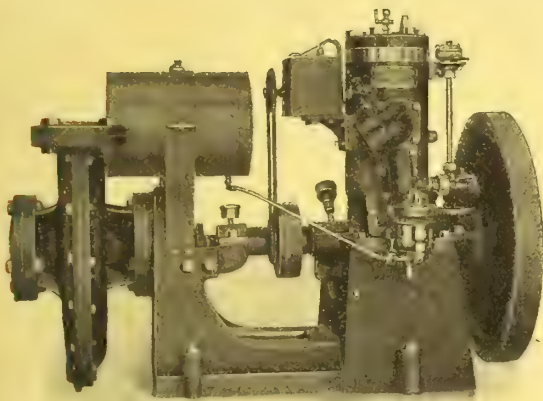
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ESTABLISHED 1886

and Engineering Review

We stand behind our Pumps
Entire satisfaction guaranteed



The SMART-TURNER MACHINE CO., Limited
HAMILTON, CANADA

"MADE IN CANADA"

Bent Glass

Made in all
Kinds of
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on Short
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Fronts a Specialty

The Toronto Plate Glass Importing
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OF BELLISS MAKE

have gained their reputation for

Simplicity of Design
Noiseless Running
Compact Design
Low Oil Consumption
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Overall Efficiency

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Continuous and Machine Banded Wood Stave

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RESERVOIR TANKS

for city and town Water Systems,
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One-half the cost of Iron Pipe—
and better.

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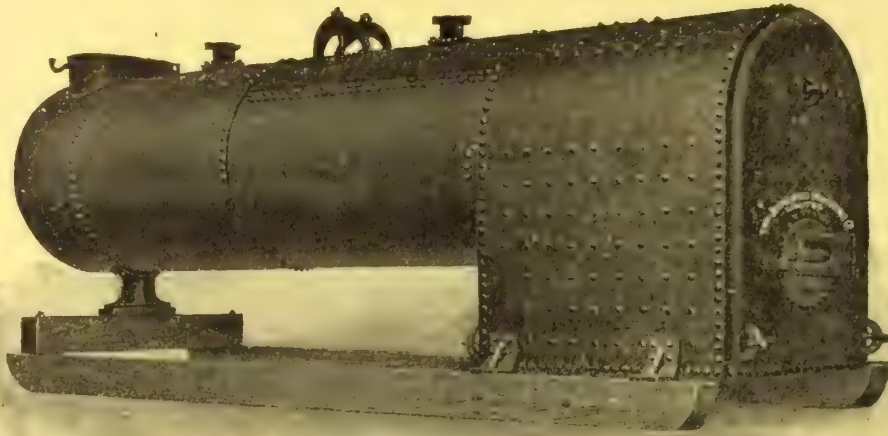
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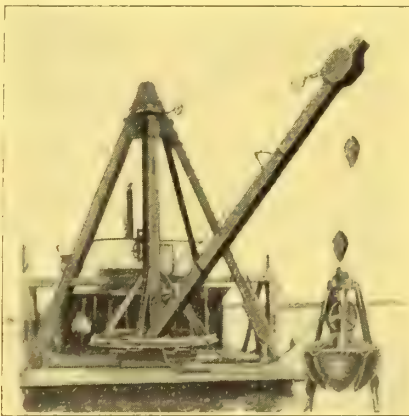
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Portable and Stationary Locomotive Boilers for every phase of contracting work.



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**“Where Repair Facilities Are
Poor, Use
‘AMERICAN’ ENGINES”**

That seems to be the sentiment of many hoisting engine users and is the result of actual experience with the low repair upkeep of “AMERICAN” Engines.

The dredge shown herewith is located 300 miles north of Edmonton, Alta., the nearest repair point; 200 miles from the end of the railroad. It is operated by a No. 145 “AMERICAN” Engine bought by the Dominion Government in 1907.

There are no weak spots in “AMERICAN” Engines. For almost a third of a century we have been striving to produce a “repairless engine;” that we have succeeded, to all intents and purposes is proved by the fact that for work in un-get-at-able places “AMERICAN” Engines are preferred.

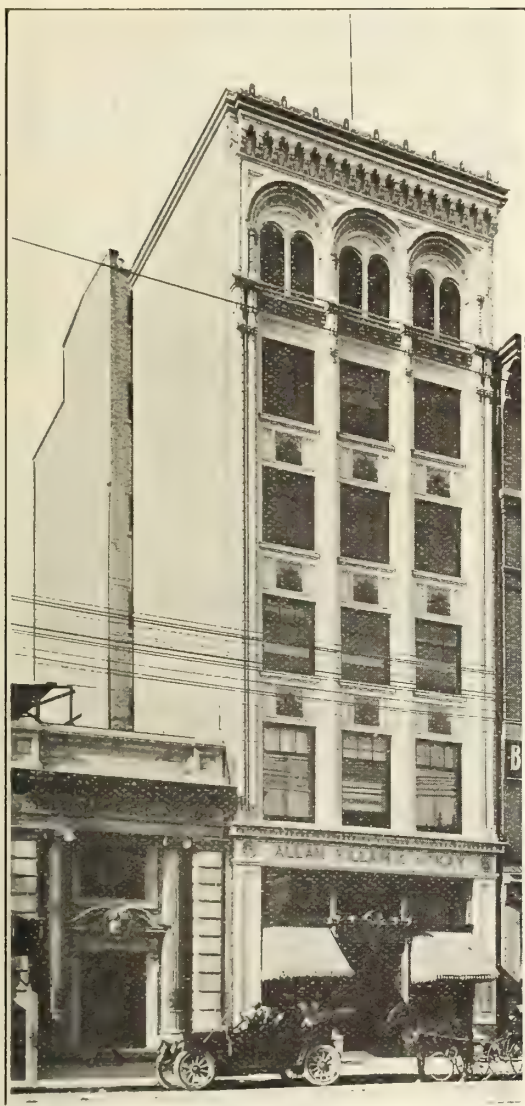
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Canada Cement used exclusively.*

The Adaptability of Concrete to Buildings

The fact that concrete may be moulded into almost any form, makes its use particularly advantageous in buildings necessitating special construction.

Its great strength, economy and durability, combined with almost unlimited possibilities in obtaining artistic effects, destines it to become the ultimate standard for office building construction.

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We have complete information regarding every class of concrete building construction that will be sent to architects, engineers and contractors upon request. This information will prove valuable in preparing plans for other buildings.

Information Department



Canada Cement Company

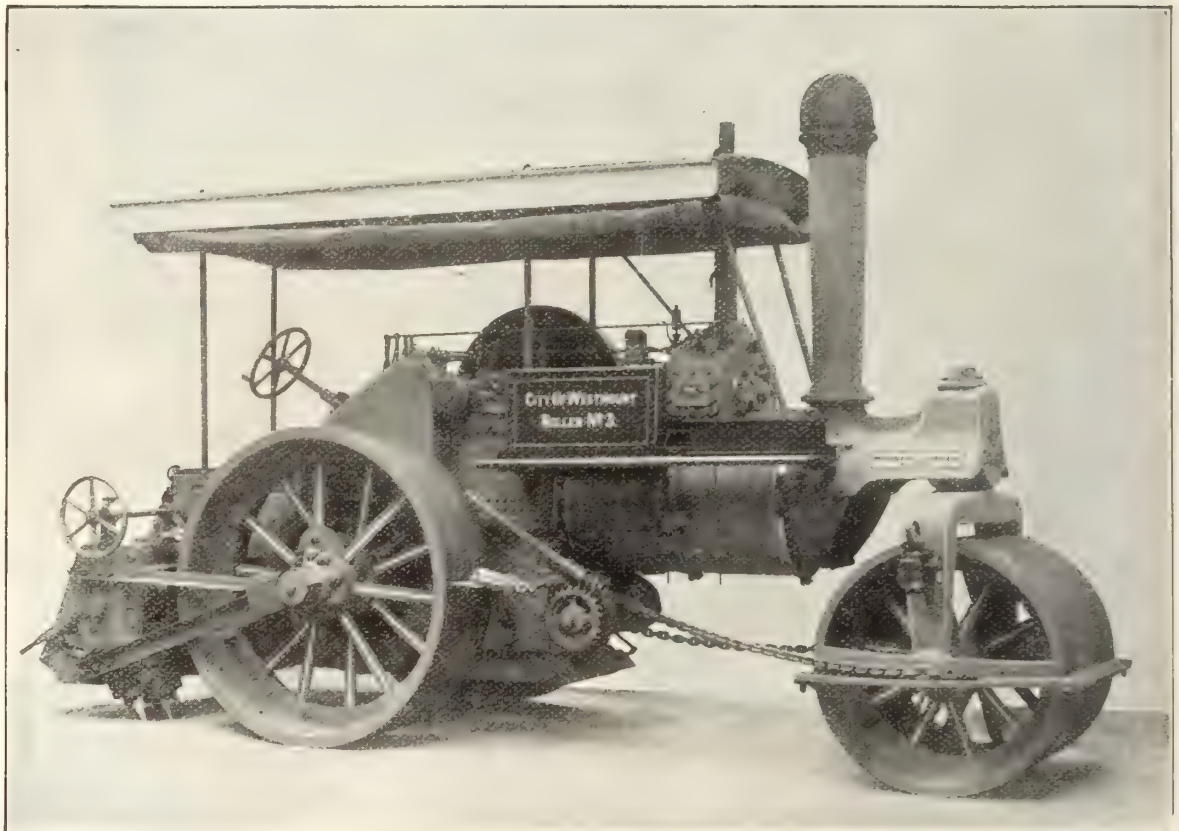
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886 Herald Building
Montreal

— REPAIRS COUNT — RUSTON-PROCTOR STEAM ROAD ROLLERS

Contain the best material and workmanship and require few repairs.



RUSTON ROLLERS are the easiest on repairs of any
Steam Roller on the market.

*If you are buying a roller let us send you our catalogue
explaining the many features of the RUSTON.*

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TORONTO, 155 West Richmond St.
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WINNIPEG, 259-261 Stanley Street
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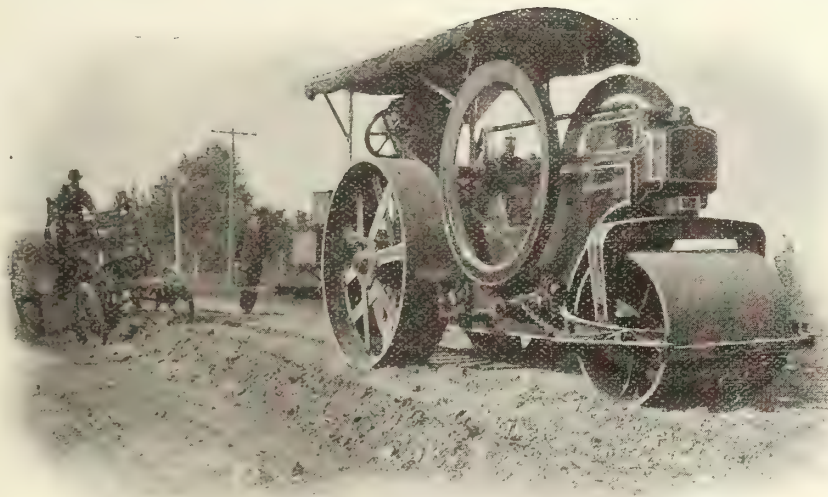
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**Will do more work at less cost than any
other motor roller on the market.**

**Easy to
start up.**

**Easy to
operate.**

**Tandem
or three
wheeled
type.**



**Nosmoke
steam or
soot.**

**Operated
on low-
grade
gasoline,
distillate,
kerosene
or
alcohol.**

Three Wheeled Type—7, 8, 10, 12, 15 Tons.

Tandem Type—5, 6, 7, 8 Tons.

May be used for driving other machinery.

Embodies all modern refinements and conveniences of operation which a high-grade motor driven machine can offer and its economy and efficiency makes it a most profitable investment.

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(Continued on page 12)



Residence of W. W. Butler, Cote St. Antoine Road, Montreal.
Robt. Findlay, 10 Phillips Place, Architect.

Don Valley Brick

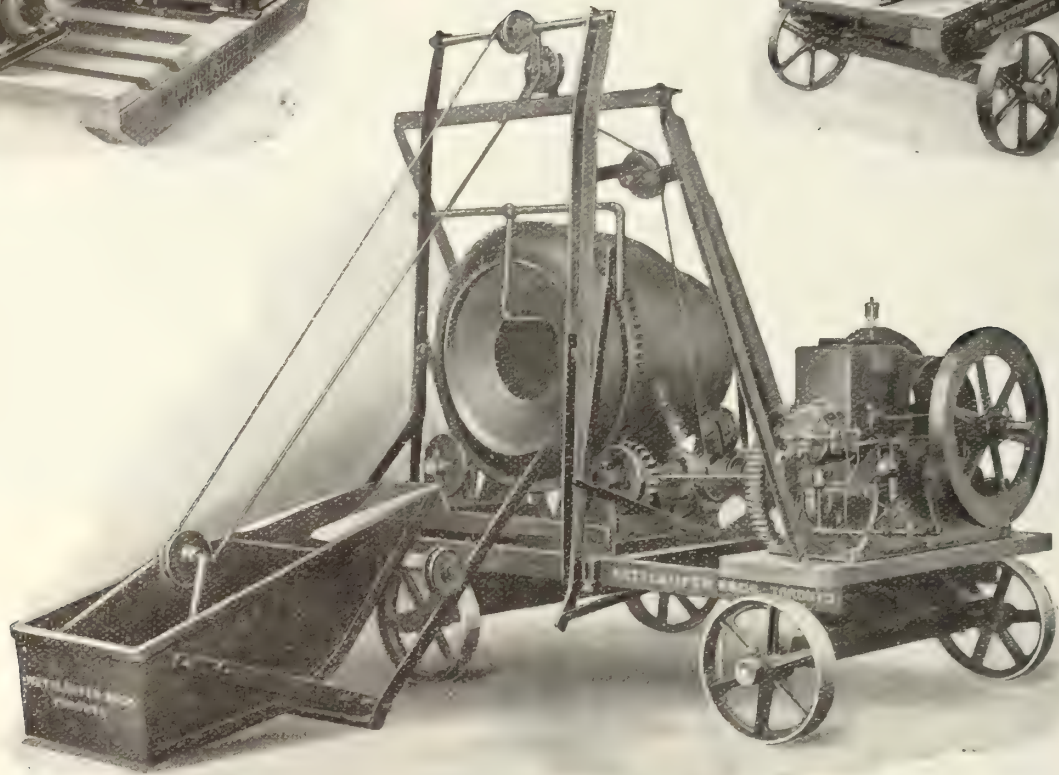
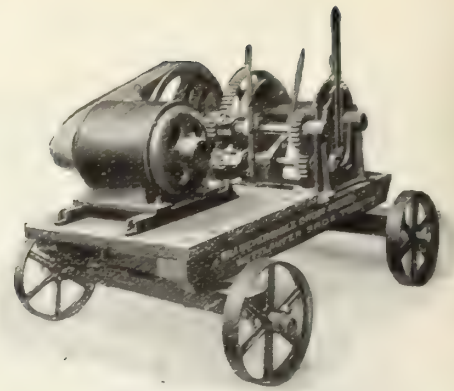
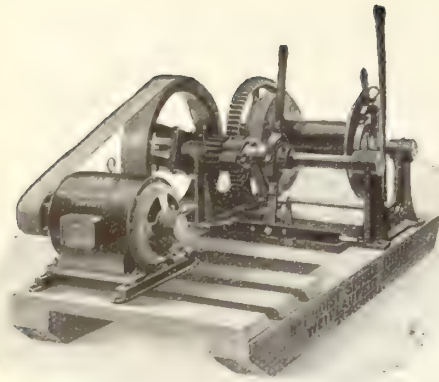
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The illustration shows a handsome Montreal residence in which Don Valley Bricks were used. The resultant rich effect of the brick work thoroughly justified the architect in specifying "Don Valley Bricks."

Don Valley Porous Terra Cotta Fireproofing is used for fireproofing most large buildings.

Don Valley Brick Works

Toronto, Ontario



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Concrete Mixers, Steam and Electric Hoists, Brick Machines, Pumps, Crushers, Stone Screens, Gasoline Engines, Steam Engines and Boilers

Write us for particulars

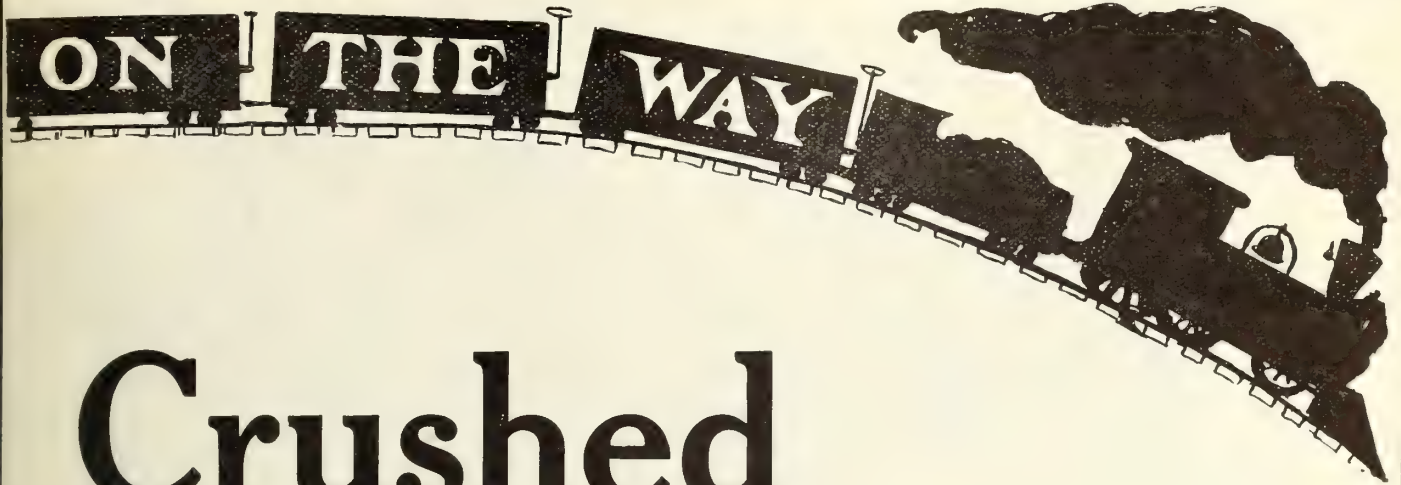
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Our bins are always loaded to the top with stone of all grades and shipments can be made the day your order is received.

Quarries located at Dundas and Vinemount.

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Send us your next order.

Alfred Rogers

Limited

28 King St. West, Toronto

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

VITREOUS FACE BRICK



OUR BRICK SHOWROOM IN MAIL BUILDING

Keep the following Names
in Mind when Ordering
High Grade Brick.

Beaver Clay Mfg. Co.
Columbus Brick and
Terra Cotta Co.

Hydraulic-Press Brick
Co.

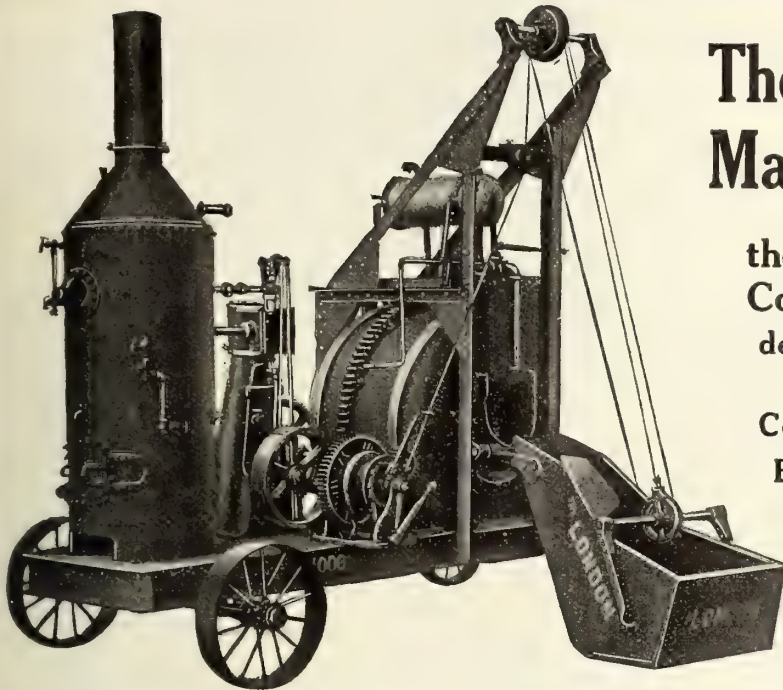
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Clay Co.

Kushequa Brick Co.
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Co.

Pearl Clay Products
Co.

Tiffany Enameled
Brick Co.

BLACK BUILDING SUPPLY CO., LTD. - TORONTO



London Standard Drum Batch Mixer
This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

The London Concrete Machinery Co., Limited

the Largest Manufacturers of
Concrete Machinery in Canada,
desire to quote prices to intending
purchasers of

Concrete Mixers, Hoisting Engines,
Block Machines, Brick Machines,
Tile Moulds, Derricks, Cars,
Pumping Outfits and Scrapers.

Head Office and Factory
London - Ont.

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TORONTO (112 York St.) F. D. Emsley, Mgr.

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FORT WILLIAM, Northern Eng. & Supply Co. MONTREAL, Foss & Hill Mach. Co. QUEBEC, A. D. Masson

The Specification of

SHERARDIZED HERRINGBONE LATH

is the

DISTINGUISHING FEATURE

of

SUPERLATIVELY GOOD CONSTRUCTION

Clarence W. Noble,

Winnipeg

General Sales Agent

117 Home Life Building, TORONTO

Montreal

The Metal Shingle & Siding Company, Manufacturers

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

- | | | | |
|--|---|---|---|
| Field Instruments
Gurley, W. & L. E.

Filters
American Water Softener Co.

Fire Brick
Improved Equipment Co.
Ontario Lime Co., Ltd.
Smyth & Ryan

Fire Escapes
Manitoba Bridge & Iron Works.
McGregor & McIntyre

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Feather & Roadhouse
Metal Shingle & Siding Co.
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Ormsby Co., Limited, A. B.
Pedlar People Limited.
Steel & Radiation Limited

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Lecky & Collis

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Consumers Gas Co.

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Canadian Buffalo Forge Co.
Sheldons Limited
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Consolidated Glass Co.
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Luxfer Prism Co.
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Dull Co., Raymond W.

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Canadian Ingersoll-Rand Co.

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Boving Company of Canada
Escher Wyss & Co.
Mannesmann Tube Company.
Pittsburgh Valve, Foundry &
Construction Company

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Roelofson Elevator Works

Hoisting Apparatus
American Hoist & Derrick Co.
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Browning Company
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Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
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Lecky & Collis
Marsh & Henthorn
Morris Hoist & Crane Co., Her-
bert.
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Royce Limited
Sturtevant Co. of Can. Ltd., B. F. | Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Co.
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Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
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Gartshore-Thomson Pipe Co.
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of Canada, Limited

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Rhodes Curry & Co.

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Morris Crane & Hoist Co., Her-
bert.

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Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.
Canadian Sirocco Co.
Berg Machinery Mfg. Co.

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Lister & Co., Ltd., R. A.

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Jamieson Lime Co.
Ontario Lime Co., Ltd. | Locomotives
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Canadian Allis-Chalmers, Ltd.
Canadian Locomotive Company
Montreal Locomotive Works
F. H. Hopkins Co.
Mussels Limited

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Mississquoi-Lautz Corporation

Metal Lath
Greening Wire Co., B.
Metallic Roofing Co.
Noble, C. W.
Pedlar People Limited.
Steel & Radiation Ltd

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Ferranti Electrical Mfg. Co.
Canadian Allis-Chalmers, Ltd.

Meters, Water
Hopkins & Co., F. H.
McDougall Caledonian Iron Wks
Neptune Meter Co.

Overhead Runways
Morris Crane & Hoist Co., Her-
bert.

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Dominion Paint Works
Goheen Mfg. Co.
Hopkins & Co., F. H.
Montreal Locomotive Works
Mussels Limited
Rock & Power Machinery, Ltd.
Thew Automatic Shovel Co. |
|--|---|---|---|

(Continued on Page 14)



Ferranti Transformers

A transformer to be efficient must be economical to install, economical to operate and must have a minimum of core and copper loss. These good points will be found in Ferranti Three Phase Transformers.

Whether on the line or in the station Ferranti Transformers will give all-day high efficiency.

The design is very substantial and all parts are easily accessible.

Let us quote you prices

The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

Farmers' Advocate Building,
Cor. Notre Dame & Langside,

WINNIPEG



Mr. Carl L. Falstrem of Parry Sound, just finishing a street crossing with "Abram" Wrist Motion Tools. His Unsolicited Letter.

CARL L. FALSTREM
GENERAL CONTRACTOR
HARDING AND BROS. BY APPOINTMENT
CONCRETE WORK & REPAIRS

PARRY SOUND ONT Aug 25, 1913.

*Abram cement tools
Windsor Ont.*

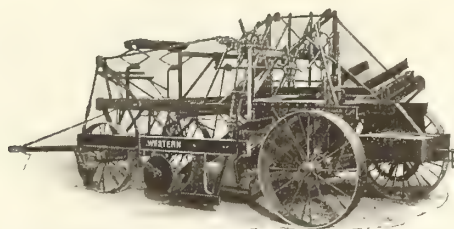
Esq Sirs

*I must say that your tools
are all you claim for them three men
with the old style tools could not do as
much nor as fine a job as one man with
your tools. I for my sake would not
use any other tools in sidewalk work or
in laying floors.*

Yours truly
C. L. Falstrem

ABRAM CEMENT TOOL CO., WINDSOR, ONT.

Load Your
Wagons with a **WESTERN**



The contractor who wants the best Dump Wagon on the market purchases a Western. In the same way the Western Elevating Grader is his choice when investing in a wagon loader.

Western Elevating Grader

The Western will load wagons of $1\frac{1}{2}$ yards capacity at the rate of three wagons per minute and one hundred per hour.

WRITE US FOR CATALOGUE

Western Wheeled Scraper Co.
AURORA, ILLINOIS

Earth and Stone Handling Machinery
Dominion Equipment & Supply Co., Winnipeg-Calgary-
Edmonton—Agents for Manitoba, Saskatchewan & Alberta
Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads



*must be built
of a*

Tough Stone

*that
will cement*

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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Paints (Bridge and Structural Iron and Pipe Coating)

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Ottawa Paint Co.

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Baker Co., R. D.
Barber Asphalt Paving Co.
Dominion Creosoting Company
Ontario Asphalt Block Co.
Paterson Mfg. Co., B.

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Canada Wire & Iron Goods Co.
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Canadian Pipe Co.
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Dominion Wood Pipe Co.
Gartshore-Thomson Pipe Co.
Mannesmann Tube Company.
National Concrete Mfg. Co.
National Iron Works
National Pipe & Foundry Co.
Pacific Coast Pipe Co.
Piggott & Co., Thos.
United States Cast Iron Pipe Co.
Walsh Plate & Structural Works.

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Browning Company
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Albert Mfg. Company
Britnell & Company
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Plumbing

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Canadian Fairbanks-Morse Co.

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Bechtels Limited

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Boving Company of Canada
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Canadian Sirocco Co.
Cook, A. D.
Gray Mfg. & Machine Co.
Hamilton Mfg. Co., Wm.
Honig & Mock.
Inglis & Company, John
McDougall Caledonian Iron Wks.
Smart-Turner Machine Co.
Waterous Engine Works Co.
Mussens Limited
Ontario Wind Eng. & Pump Co.
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Jenckes Machine Company
Canadian Allis-Chalmers, Ltd.
Waterous Engine Works

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Lecky & Collis
George Anderson & Co.
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Hopkins & Co., F. H.
Lecky & Collis
Mussens Limited

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Equipment & Supplies, Limited.
Linde British Refrigeration Co.

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Greening Wire Co., B.
Pedlar People Limited.
Steel Company of Canada
Steel & Radiation Ltd.
Trussed Concrete Steel Co.
Turner, C. A. P.

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Asphalt & Supply Co.

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Lecky & Collis
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Mussens Limited
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Barber Asphalt Paving Co.
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Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
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Canada Iron Corporation
Dominion Sewer Pipe Co.
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National Iron Works
Nova Scotia Clay Works Ltd.
Ontario Lime Co., Ltd.
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.

Sewer Trenching

Lecky & Collis

Sound Deadening

Cabot, Inc., Samuel

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What Big Contractors

Say About This Koppel Car

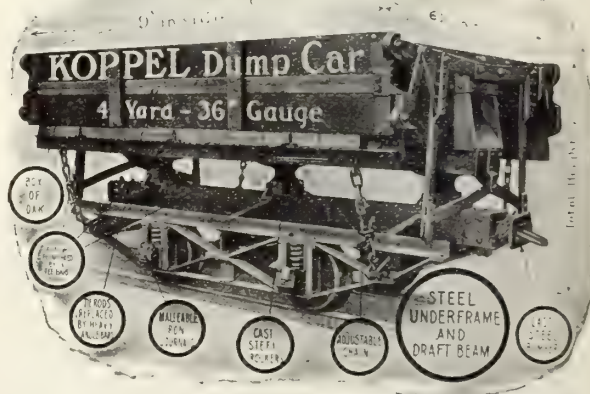
Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.



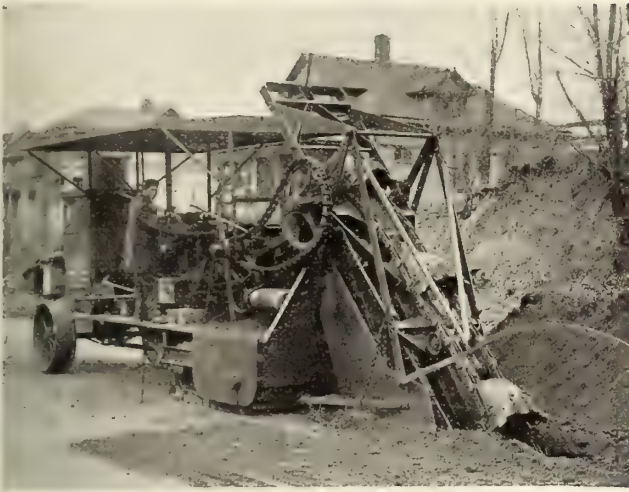
Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

83 Miles of Trench in 63 Working Days



That's the record a contractor established at Edmonton, Alberta with

2 Austin Trench Excavators

The going was very difficult at times and the trenches were deep in many places. On one reach they "Dug in hard clay at rate of 3 lineal feet per minute with one foot of shale in bottom of the ditch." How do these records compare with the results you are getting? It will pay you to get our figures on excavation costs under various conditions and compare them with yours. You will soon see why the "contractor who has an Austin Trench Excavator has an 'edge' on every competitor who is putting in a bid against him"

For details write our Canadian Representatives

Lecky & Collis, 335-A Craig St., Montreal, Quebec, and Napanee, Ontario.

The Canadian Equipment & Supply Co., Calgary

E. G. Cullen, Vancouver

F. C. Austin Drainage Excavator Company

Railway Exchange, Chicago, U. S. A.

NOTE THE PERPENDICULAR POSITION OF THE Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto

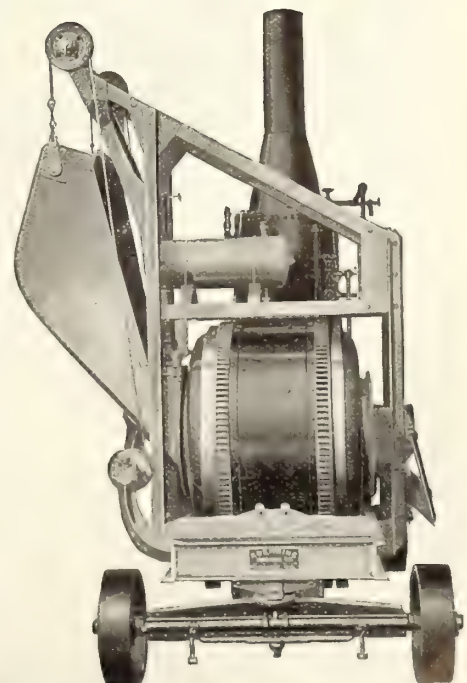
Winnipeg

Calgary

Vancouver

Montreal

Ottawa



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McGregor & McIntyre

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Gray Mfg. & Machine Co.

Steel Trucks

Gray Mfg. & Machine Co.

Steel Tubes

Mannesmann Tube Co.

Steam Turbines

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McDougall Caledonian Iron Wks.

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Canada Steel Co., Ltd.
Can. Billings & Spencer
Lucky & Collis

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Steel Co. of Canada
Steel & Radiation, Ltd.

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Mannesmann Tube Company.

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Sackville Freestone Company
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Smyth & Ryan

Stone Saws

Anderson, Geo.

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Canada Steel Company
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Dominion Bridge Company
Hamilton Bridge Works Co.
Mackinnon Holmes & Co.
Manitoba Bridge & Iron Works
Maritime Bridge Company
McGregor & McIntyre
Phoenix Bridge & Iron Works
Pittsburgh-DesMoines Steel Co.
Reid & Brown
Sarnia Bridge Company
Steel Company of Canada
Structural Steel Company
Standard Steel Construction Co.
Toronto Structural Steel Co.
Walsh Plate & Structural Works

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Lucky & Collis

Swinging Gears

Dake Engine Company

Tanks and Stand Pipes

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Hamilton Mfg. Co., Wm.
Ingilis, John
Jenckes Machine Co.
Manitoba Bridge & Iron Works.
Marsh & Henthorn
McDougall Caledonian Iron Wks.
Ontario Wind Eng. & Pump Co.
Piggott & Co., Thos.
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Manitoba Bridge & Iron Works.

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Escher Wyss & Co.
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McDougall Caledonian Iron Wks.

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Greening Wire Co., B.
Steel Company of Canada

Wrenches

Canadian Billings & Spencer, Ltd.

Wrenches

Can. Billings & Spencer, Ltd.

The Oldest Way and the Newest Way



This little scene from a Texas road job shows an unusual coming together of the oldest way of hauling and the very newest way--the ox team and Troy Reversible Wagons with a traction engine. The horse replaced the ox in hauling work because the horse was more efficient. The horse did more work and better work for the money.

The horse still has its place but on big hauling jobs the horse must go just as surely as the ox did. Troy Reversibles with an engine will do the work better at from 1 to 10 the cost.

If you have a big hauling job or think you may have some day, you ought to have
our Hauling Catalog 22. We'll be glad to send it to you.

The Troy Wagon Works Co., North Market Street, Troy, Ohio

Canadian Equipment Supply Co., Calgary.
J. D. Patterson, Hamilton.
W. McNally & Co., Montreal.
E. G. Larwill, Ottawa.
Twin City Sand Co., Port Arthur.

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N. J. Dinnen & Co., Winnipeg.

Barrett Specification Roofs

Engineers—T. Pringle & Sons,
Montreal and Toronto
Roofers—R. Gilday, Toronto

The Barrett Specification Roof on the
Canadian Fairbanks-Morse Co.
Ltd., New Shop—Toronto, Ont.



The Choice of First - Class Architects

THE better the building, the more certain that it will have a Barrett Specification Roof, because first-class buildings are the work of first-class architects and engineers and they know the relative values of the different types of roofing.

They know that a Barrett Specification Roof consists of five layers of Specification Felt cemented together with continuous layers of Specification Pitch, with a top surface of slag or gravel. It is built on the roof without the narrow joints or laps of tin or ready roofings.

They know that a Barrett Specification Roof is a substantial, fire-resistant roof, accepted at base rates by insurance underwriters.

They know, further, that its cost is less than that of any other permanent roofing and that its maintenance cost is nothing, making a net cost per foot per year of service, of about $\frac{1}{4}$ cent.

A copy of the Barrett Specification will be sent, on request, to any architect, engineer or property owner. It formulates a precise and practical way of laying these roofs to secure the best results at the least expense. Address our nearest office.

Special Note

We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

If any abbreviated form is desired, however, the following is suggested.

ROOFING — Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15th, 1911, using the materials specified and subject to the inspection requirement.

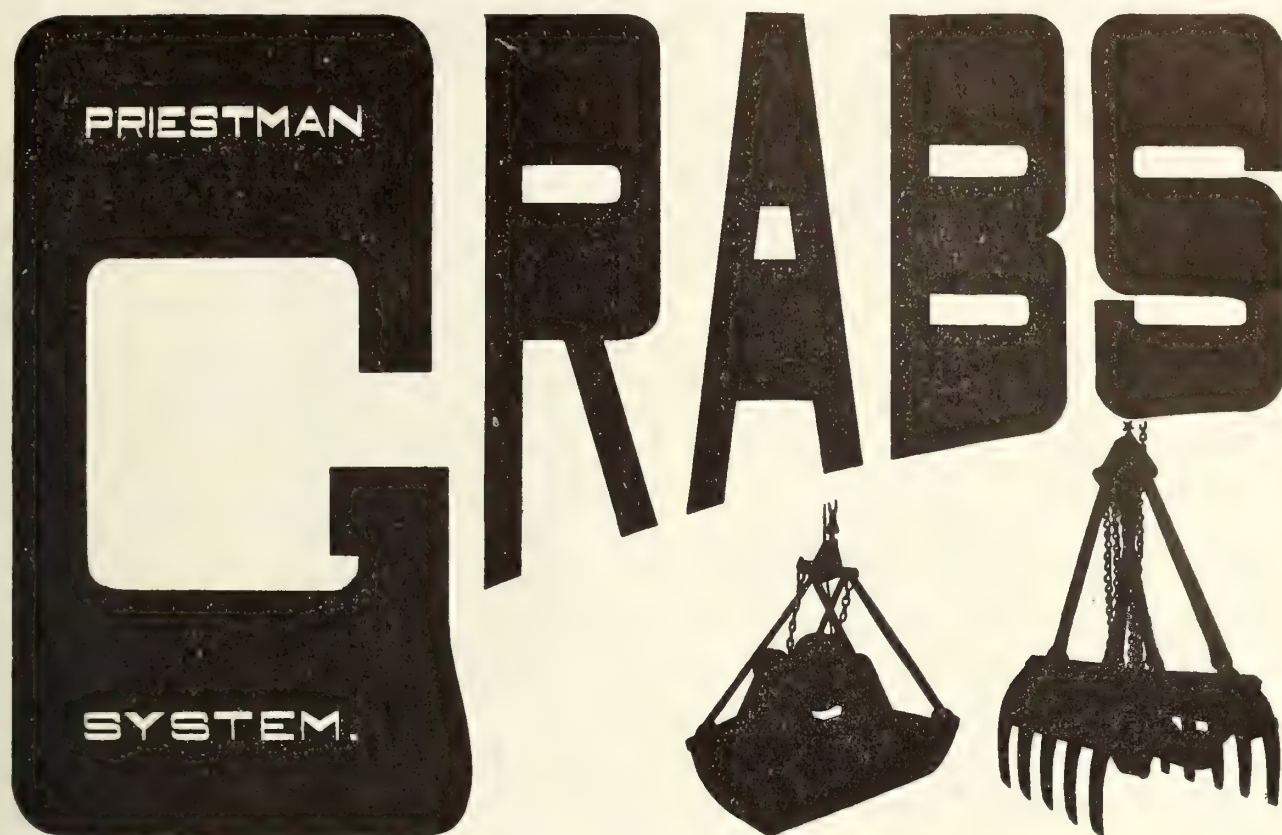
THE PATERSON MANUFACTURING CO., Limited

Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.

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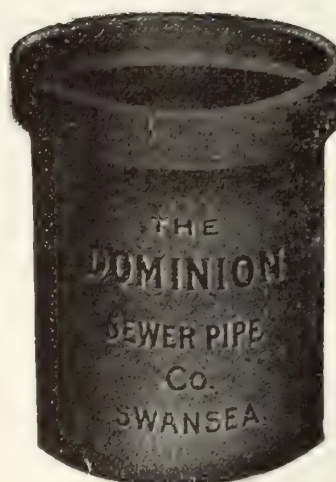
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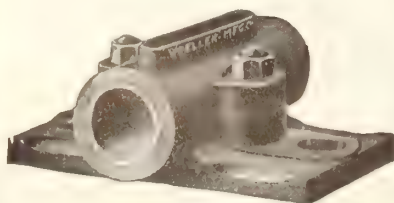
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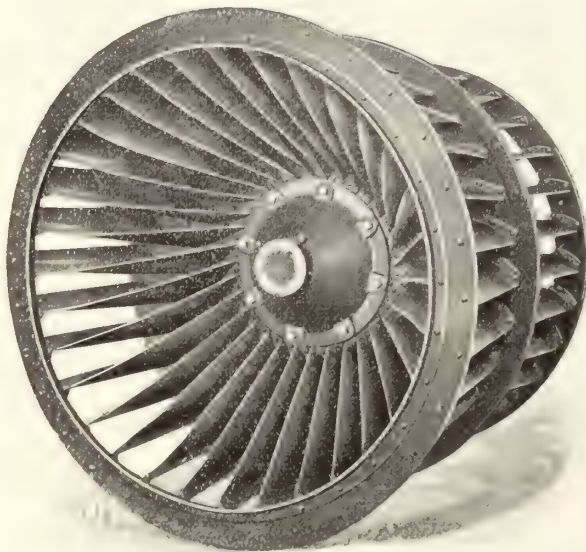
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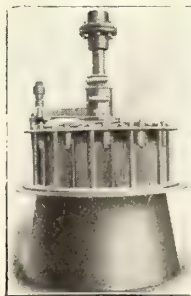
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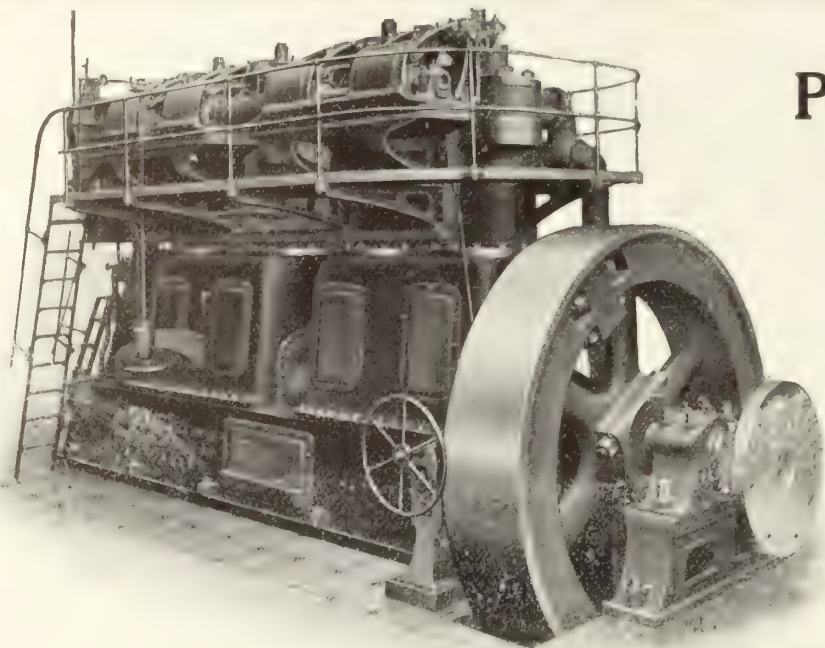
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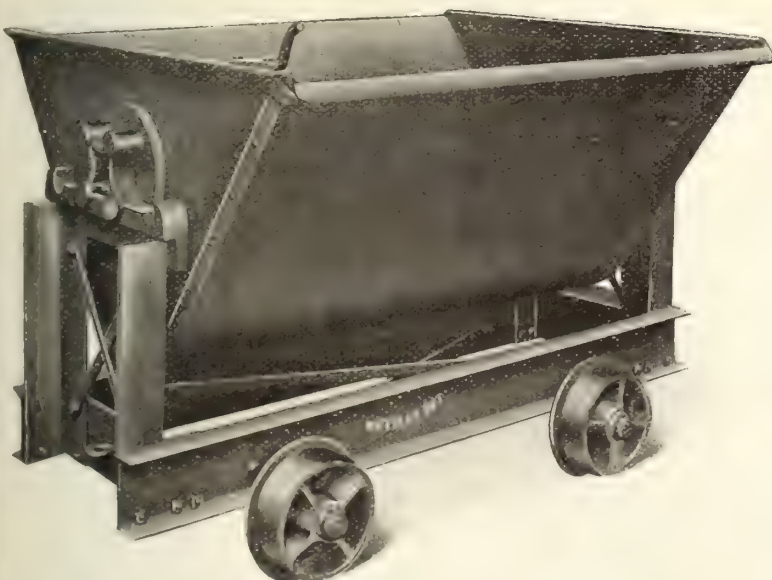
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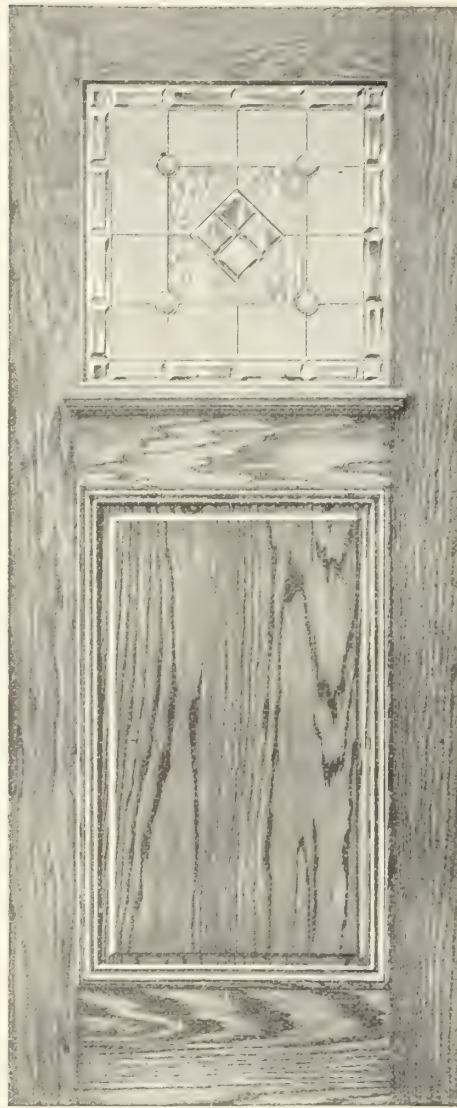
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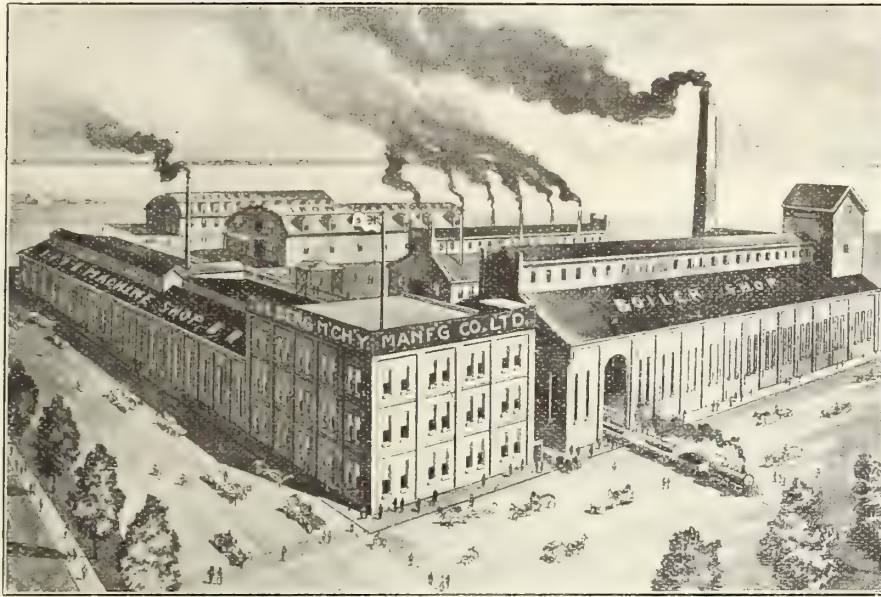


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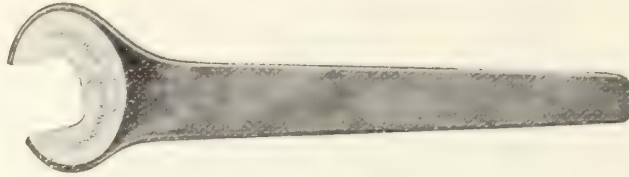
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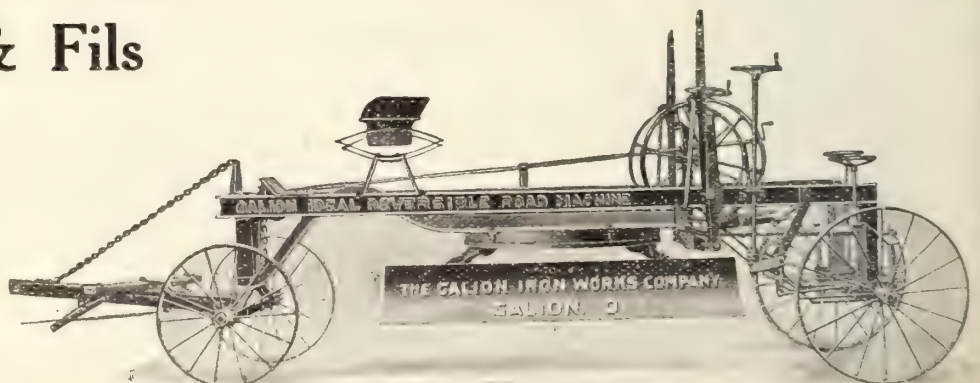
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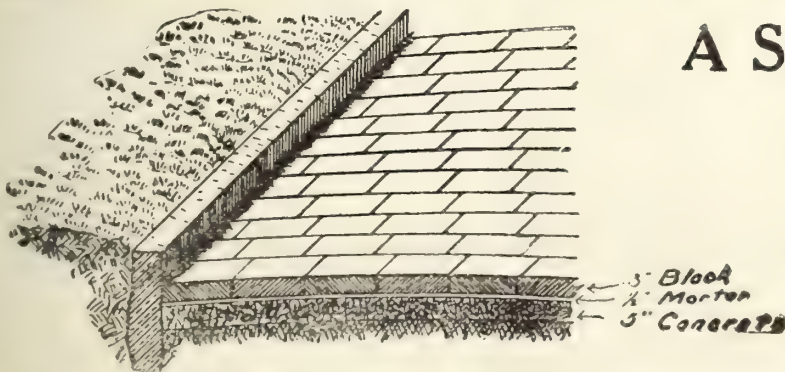
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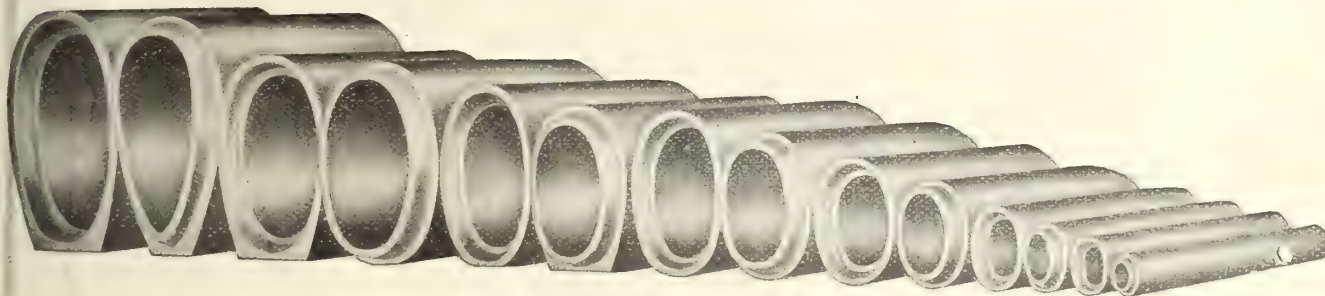
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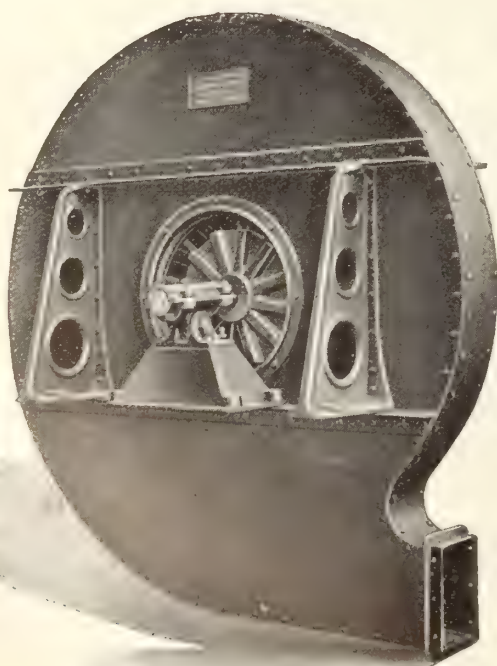
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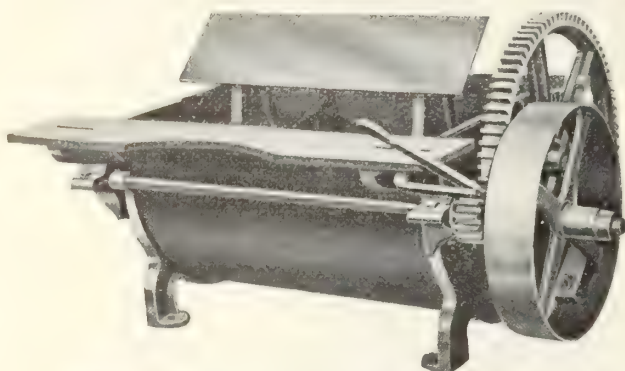
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Contract Record

ESTABLISHED 1886

and Engineering Review

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A Timely Enjoiner

FROM a perusal of the advertisements for tenders published in recent issues of this journal and by a comparison of such advertisements with those published a few years ago, one can discern an increasing tendency on the part of local authorities and public works officials to secure their bids well in advance of the active constructional season. Time was when it was the rule rather than the exception to devote the first half of the year to arranging preliminaries which should have been cleared up during the winter. We do not doubt that not

a few shortcomings of this kind will come to light a little later on in the present year of grace, but improvement is noticeable, and for such improvement the contracting community is truly thankful.

As a matter of fact there is no excuse for dilatoriness of this kind on the part of municipal officials, and where the legal formalities and other preliminaries connected with public works are extended well on into the spring the responsibility should be established and the authorities made answerable to the ratepayers.

There are many reasons for securing bids well ahead of time,—reasons which are so patent that it would appear purposeless to recount them, but we cannot refrain from emphasizing the fact that in the slack winter season contractors have all the time at their disposal to submit carefully detailed bids and afterwards make their arrangements for carrying out the contract. The advantages, moreover, are evenly divided between the contractor and the municipality. We learn that the Maryland State Roads Commission in response to an advertisement for proposals on six contracts, aggregating about thirty miles of road, received tenders from forty to fifty contractors, representing in all nearly one hundred bids. This illustrates very strongly the ensuing advantages of keen competition and the resultant lower prices.

Reports from all sections of the country, in every department of constructional enterprise, indicate that the season of 1914 will be one of exceptional activity and we would strongly urge upon those who have been dilatory as regards the preliminary details of any engineering and building project to make up for lost time and to publish their advertisements for tenders before the responsible firms are loaded up to capacity and are too busy to consider any more jobs—except at a fancy figure.

The Example of Duluth

COMPANIONSHIP in misery has often sustained an individual and nerved him to fresh endeavor. This is a matter of history, not of philosophy. The thought comes to us upon hearing that the city engineer of Duluth, Minn., has resigned on account of unjust and malicious criticism of his department. The news hardly brings with it a measure of gratification, for two wrongs do not make one right and no individual betterment is brought about by a knowledge of the discomfiture of others. Nevertheless, there is a modicum of comfort for municipal engineers in Canada in the reflection that bad and undesirable as are the conditions under which they live and have their being, at least they are as bad elsewhere. The "retiring" city engineer of Duluth submitted a letter of resignation which almost rivals the last records of the great Captain Scott in its simple, telling force. He condemns the wanton persecution of city officials and deplores the kind of criticism which is the outgrowth of ulterior motives. There is a note of self-reliance in his statement that he has no apologies to make. There is a considerate thought for his successors in his commendation of his staff and his plea for their encouragement.

The resignation of Duluth's city engineer seems to have attracted some little attention—possibly because the conditions which gave rise to it are unusual. We cannot but feel concerned as to what would happen if the municipal engineers of Canada were to resign on

the ground of malicious persecution or ignorant opposition. Trailing along somewhere behind the name of engineerless Duluth would be the names of practically every municipality in Canada, if an honor list were compiled. We may congratulate ourselves that one-half of the city and town engineers in Canada do not follow the example of Mr. John Wilson, of Duluth,—and wonder why they don't. Perhaps it is because they have something of the spirit of Omar:—

"Unborn to-morrow and dead yesterday:
Why fret about them if to-day be sweet?"

Valuable Report on Pollution of Water Supplies

"The position of intake and the pollution existing in the vicinity of municipal water supplies are such that there is not a municipality using lake water which can be said to possess a safe water supply without treatment. . . . In certain localities the pollution is so great as to impose an unreasonable burden upon any known method of water purification."

FULFILLING the obligations of a treaty between Great Britain and the United States, whereby the pollution of the boundary waters of Canada and the United States was prohibited, an investigation has been made by an International Joint Commission, an abstract of whose report is printed elsewhere in this issue. The present report is confined to the extent and causes of pollution.

At the time of writing we are informed by the Ontario Health Department that copies of the report, with the accompanying maps, are "still in the printer's hands," and so we owe our information to The Engineering Record whose editorial on the subject (abstracted below) contains many suggestive points:

"The report shows a very painstaking and thorough examination of the extent of bacterial pollution. The commission finds that the great bulk of the water of the Great Lakes remain in its pristine purity, but that dangerous sewage pollution exists at certain points in the lakes and in the connecting waterways. Most of this comes, of course, from the sewage discharge of cities, and some from steamboats. The commission also finds that practically all drinking-water supplies from the lakes must be adequately purified to make them safe; they also find that where pollution is great, hypochlorite treatment is often ineffective.

"On the basis of their investigations the next problem before the commission is to determine 'in what way or manner it is possible or advisable to remedy or prevent the pollution of these waters' within the limits of the intent of the Treaty of 1909. This is indeed a large problem of many aspects. The basic question is whether or not the boundary waters shall be maintained in such condition that they shall be suitable for drinking water supplies without any purification. That such a uniformly high standard is in all cases possible of attainment is very much doubted, and if it should be possible it would not always be worth the effort. A very well balanced statement may be found in the report of the British Royal Commission on Sewage Disposal, for 1908, in referring to their river waters. It may be equally well applied to our boundary waters. That commission states:

"We are satisfied that rivers generally, those traversing agricultural as well as those draining manufacturing or urban areas, are necessarily exposed to other pollutions besides sewage, and it appears to us

therefore, that any authority taking water from such rivers for the purpose of water supply must be held to be aware of the risks to which the water is exposed, and that it should be regarded as part of the duty of that authority, systematically and thoroughly, to purify the water before distributing it to their customers.

"Apart from the question of drinking waters, we find no evidence to show that the mere presence of organisms of a noxious character in a river constitutes a danger to public health or destroys the amenities of the river. Generally speaking, therefore, we do not consider that in the present state of knowledge we should be justified in recommending that it should be the duty of a local authority to treat its sewage so that it should be bacteriologically pure."

"On the other hand, there may be places where pollution is so gross that an undue burden is placed on water purification plants, and the best of these plants may at times fail to make the water absolutely safe. For such conditions the sewage should be subjected to such reasonable amount of treatment as to leave the water, while not pure from a bacteriological standpoint, at least reasonably clean, so that it can be readily purified for use as a domestic supply.

"The amount of such treatment is a matter to be determined after consideration of local conditions. It requires for each place a study of the amount and character of the sewage discharged, the amount of diluting water, the nature of the water currents, the effect of wind on these water currents, the effect of stratification and many other special features. It requires, too, a study of the costs of various purification methods when applied to the local conditions, and the results that can be obtained.

"Besides this careful engineering examination of the sewage treatment problems of these cities' on boundary waters, the commission must very carefully consider the views of the officials and the people of the cities interested. It is fundamental that any rules established which are not in accord with the enlightened public sentiment of the communities on which they are imposed will fail of effect, and for the commission's efforts to lead to practical results it must consider this local public sentiment and see to it that its rules will be such that the municipal authorities and the taxpayers can appreciate their reasonableness.

"After such a detailed study of the special features presented by the various localities interested, of the amount of purification which can to advantage be insisted on, and its cost, the commission can formulate a general policy and a set of standards. These standards, to be general in their nature, ought to specify, not the degree of purification which the sewage discharge of any city under the diverse existing conditions must receive, but rather the degree of pollution which is to be permitted in the lake or river water into which the sewage effluent is discharged. A similar standard has been adopted by the British Royal Commission in its Eighth Report.

"A report to the National Association for Preventing the Pollution of Rivers and Waterways by its committee on standards, dated October 22, 1912, considers this problem in a very general way. The field work report of the commission gives the needed objective data on existing conditions. The next step is to get the views of the interested communities as to existing conditions, and their ability to better them. The final step will be to correlate these various data and opinions in the light of the best expert sanitary knowledge, and to establish an acceptable standard."

The Building Contractor—His Problems and Methods

CONTRACTING companies have not often made public the detailed methods used by them in organizing for and in carrying out their various contracts. The result is that there is considerable mystery surrounding the work of contractors, and owners and engineers have in some cases looked upon such men with suspicion, comments our Chicago contemporary, *Engineering and Contracting*, in an editorial article devoted to a consideration of a paper on the above subject by Mr. Leonard C. Wason, of the Aberthaw Construction Company, Boston. However, conditions are changing, and it is being realized that an efficient, organization and open dealings with owners and engineers are important assets of a company, and that the publication of construction methods used on particular jobs constitutes legitimate and profitable advertising. Further, the publication of this information should tend to cause engineers to adopt types of construction which can be erected economically. Some firms have failed because they did not appreciate the necessity of good business methods—others have not possessed sufficient flexibility in their organization to meet the changing character of work. Some have engaged in more work than their capital and equipment justified, and thus were not able to provide for emergencies. The willingness of some contractors to take work on a speculative basis has not given the best results, either to the contractor or to the owner, as both are entitled to a fair return on their investment.

Many companies are now glad to take work on a cost-plus-percentage-basis, which simply means that the speculative element is omitted and that only a fair return is expected. With this form of contract the contractor rents his equipment and organization and becomes the owner's broker in the purchase of materials; while the owner furnishes the capital required to provide for depreciation of the contractor's plant, the cost of labor and a fair profit. Contracting companies working on this basis must rely mainly upon their ability to give good service and to do reliable work in order to insure future contracts.

It is highly desirable to thoroughly understand the temperament of the owner, architect and engineer if harmonious work is to be done. Contractors soon learn what treatment to expect from certain architects and owners and govern their bids accordingly. It is evident that the attitude of the owner and architect has much to do with the progress and cost of the work. The importance and the difficulty of securing good inspectors is pointed out. It is not sufficient to get an honest inspector, but it is necessary to get one who is entirely familiar with the particular kind of work which he is to inspect.

The company with which Mr. Wason is connected favors the cost-plus-fixed-sum-for-profit form of contract, as such a contract makes the interests of owner, architect and engineer identical. To emphasize the fact that the contractor for building work is largely a broker it is stated that in office building work the contractor may not handle more than 1 per cent. of the contract price as direct labor, the remainder being for materials bought and for sub-contracts let. In reinforced concrete buildings the percentage of labor is about 35 per cent. of the total cost.

The best results can be secured only by perfecting a smoothly working organization and confining the contracts to what this organization can handle. There is great risk in taking on too much work and in em-

ploying superintendents and foremen for a single job. If work is done in widely separated cities it can not be efficiently handled by the main office, as incorrect methods can not be detected and corrected soon enough to be effective. The system of carefully analyzing the design in the main office and then planning and routing the work has many advantages. The making of detailed drawings for the forms by men skilled in this branch of the work—instead of allowing the carpenters to lay out the forms—has the advantage that the lumber can be ordered in such lengths and sizes that cutting is largely avoided. Further, better results can be obtained by this method, as carpenters capable of doing the highest class of work can not often be obtained for concrete work. It is important that special study be given to determine the rate of progress necessary to complete the building on time. The crowding of work when not absolutely necessary will require greatly increased expenditures for equipment and labor. Most contractors appreciate the desirability of an efficient cost-keeping system. However, all do not realize that a system which merely enables the contractor to determine the unit costs of the completed work has little value. A system to be of greatest value must be one by which unit costs can be determined as the work progresses. Such a system enables those in charge to determine what part of the work is costing too much, thus enabling them to correct defects in time to prevent large wastes.

Activity in Road Work

IN Eastern Canada, 1914 gives every promise of being a very busy year in road work. It is rather early as yet to attempt a detailed programme of what is planned in Ontario, seeing that the various government authorities throughout the province are only holding their initial meetings and that parliament has not yet met. From enquiries made by this journal, however, we may expect an expenditure about as follows: County roads, \$900,000; Northern Ontario, \$1,000,000; townships, \$1,500,000; town and city streets, \$7,000,000; total, \$10,400,000. This is a conservative estimate from a conservative source and it may be accepted with a reasonable assurance of its accuracy. No less an amount will be expended on road work and street work in the province of Quebec, but it were too speculative to undertake an estimate of municipal and other local enterprises. We have definite information, however, that the government programme includes the construction of from 60 to 70 miles of macadam on the Montreal-Quebec road, 32 miles of macadam or gravel on the Sherbrooke-Derby-Line road and 93 miles of gravel on the Levis-Jackman road. In addition the Quebec government will supervise road-building in about 180 municipalities.

A 100-ton steam travelling crane for the Havre harbor works is described in "Engineering" of London. It was built by Cowans, Sheldon & Company, Limited, of Carlisle, England. It is capable of lifting, carrying and slewing loads up to 100 tons at a radius of 39 ft. $4\frac{1}{2}$ in., all the motions being worked by steam power, at the following speeds: Lifting 100 tons, 8.2 ft. per minute; lifting 40 tons, 20.5 ft. per minute; revolving 100 tons, 1 r.p.m.; travelling with 100 tons, 32.8 ft. per minute. The carriage is built up of steel plates and angles, and travels on eight centre-flanged cast-steel wheels which run on rails 19 ft. $8\frac{1}{4}$ in. centre to centre. All motions are worked from one set of horizontal engines with two cylinders, steam being generated in a vertical boiler.

LETTERS

"Engineering Responsibilities"

New Glasgow, N.S., Feb. 5, 1914.

Editor Contract Record:—

I believe with you that failures for which the municipal engineer is blamed are due not infrequently to the interference of city councilmen and public works boards.

The engineer in private practice is often blamed for the failure of designs in which directors of corporations and other individuals have interfered, for financial or other reasons. Last of all the general public itself interferes with matters and often uses its influence to cause trouble for the community and the engineer. Sometimes the press influences the public, to the unfortunate engineer's discomfiture. Most of your readers will readily think of one or more examples to illustrate each of the generalities above.

You contend that "a system which gives final authority in engineering matters to ill-informed politicians is fundamentally wrong." Granted that you are right, what about matters other than those of a purely engineering nature? Should your ill-informed politicians be the final authority in regard to sanitation, police, fire-protection, education, etc.?

It is indeed lamentable that better educated and more capable citizens cannot be induced to act as public representatives. It is a pity, too, that when such men occasionally seek election, ward politics often prevent their nomination.

There is a good point in the organization suggested for the city of Montreal—the six-year period of office proposed. Ordinarily the municipal engineer is appointed for only a year, or two years at the most. He may be a capable civil engineer, especially efficient in municipal engineering, and may work faithfully and to the best of his ability; but if he does not pay proper attention to the views of your "ill-informed politicians," his tenure of office will certainly not exceed the usual period of appointment. For the sake of maintaining his position, therefore, he will sometimes see things in a different light than he would if he were not influenced by such considerations.

The working out of the city-commissioner and city-manager charters will be watched with interest by municipal engineers. The city commissioner or city manager may become a despot in contrast to the present city engineer, who, as you say, is "only a servant taking instructions." But this may be better for the welfare of the city than the present arrangement; for, after all, in matters of an engineering nature, a benevolent despotism may be better than a perverted democracy.

Yours truly,
DONALD F. McLEOD.

The Montreal Water Famine

Editor Contract Record:

Your leading editorial in the issue of January 14 has interested me greatly. It is only by failures and disasters, whether they be attributable to lack of technical skill or blundering administration, that the great lessons of a new and growing country are ever learned. How is it that there are so few failures in the public works of Great Britain and Europe generally? Surely there must be some well-defined reason! Is it because the system of municipal government over there is better, or is it because of the fact that before an old country engineer is placed in charge of responsible

work he is required to have had careful training, long experience and association with one of the national engineering societies? Or,—in the case of Great Britain, is it because of the existence of the Local Government Board, which acts as a brake on all municipal expenditures and undertakings. It is such things as these that flash across the mind of an engineer who has been trained in Great Britain as he reads of the constant failures of engineering work and municipal administration in Canada.

In my opinion the present unsatisfactory record will be continued until the inauguration of a new system of government and I beg to offer the following suggestions, namely, that

- (1) All councils be elected so that an entire change take place in three years, the Mayor to be elected from the council, thus ensuring his previous experience before taking office.
- (2) All officials, such as treasurer, auditor, sanitary and building inspectors and city engineers be required to pass a qualifying examination before holding office, such officials to be approved by the controlling governing body and their duties set forth in a universal by-law, thus placing them out of the reach of the ordinary politician.
- (3) A regulating body, either Dominion or Provincial, be formed to investigate and approve of all loans and schemes over a certain amount.
- (4) Projects of large magnitude receive the approval of a qualified engineer of recognized reputation.

I must refrain from criticizing the Montreal failure, as my information has been acquired only from the papers. The point I wish to make is that there is something radically wrong with municipal administration throughout Canada, and I hope that before long steps will be taken to prevent a further waste of public monies. Much could be said upon this subject, but I feel that I have trespassed sufficiently upon the space of your valuable paper.

Yours faithfully,

"A City Engineer in Western Canada."

"A Building Can Only Contain a Certain Amount of Material."

Boston, February 4, 1914.

Editor Contract Record:

The dissatisfaction with present conditions which is the cause of the letters on "Gratuitous Bids," "Competitive Tendering" and "Fair Play to Contractors" has its source in the very large unnecessary expense to which contractors are put in making up tenders for construction work. The contractor who wishes to bid on a large job has to put in at least a week of continuous work if he wants to make a careful estimate, and the chances are that the more careful his work the less likely he is to secure the job, as a large number of contracts are let to bidders whose prices are considerably below the average of those tendering. General experience shows that such low bids are due to the tenderer's having left out some item of importance, the cost of which has to come out of his profit or else out of the job.

The editorial quoted from the "Surveyor" (Contract Record, Jan. 21, p. 66) hardly appreciates the burden of the expense of making bids that falls upon contractors in this country, as in England contractors are always furnished with a schedule of the quantities of labor and materials required in the work, and all they have to do is to price out these quantities and bring the extensions to a total. The time required to make up a bid is often less than two days, and the consequent expense to the contractor very much less than that of his American confreres.

There seem to be two remedies for this state of affairs. One, which has appeared in your columns, is that the con-

tractor should be paid for submitting a bid. It seems to me that the objections you have quoted would be sufficient to rule this out of consideration at once. Another way would be to adopt some system of furnishing schedules of quantities to the contractors tendering. The tenders need not be on unit prices, as if the quantities were correct there should be no reason why a lump sum bid could not be given, and if one independent party calculated the quantities for all parties tendering, the competition between the bidders would be limited to a competition in price, not in quantities.

As matters stand to-day, contractors are guessing against each other as to the quantities of material in the job, and if there are twelve bidders twelve men will have had to make a complete survey of the plans of a job that could just as well have been made by one. When bidders are invited to tender it is supposed that they are submitting competitive prices, but actually their bids are based upon competitive quantities before competition in price commences. This seems to be not only unfair but absurd. A building can only contain a certain amount of material and no amount of figuring by contractors against each other can make that quantity any more or less. If a bidder, through being hurried, or misled, perhaps, by plans that were not clear, leaves something out, he secures the job and the owner benefits at his expense, while the more careful man loses the job because his work is more accurate.

There seems to be an awakening interest in this subject among architects and contractors, and a society has been formed in San Francisco called the American Institute of Quantity Surveyors which is interested in this matter and is endeavoring to establish an American system of quantity surveying. A good deal of preliminary work has been done and it is hoped that before long the present unfair conditions of tendering will be largely ameliorated.

Yours very truly,
LESLIE H. ALLEN*

Instructions to Building Inspectors

THE subject of inspection in building construction is discussed very fully in a paper by Martin Schreiber. It is a department in which we are deplorably weak and the following instructions, given by Mr. Schreiber, may be found of value as defining the duties and responsibilities of a competent inspector:

(1) Carefully study all plans, elevations or other drawings; also all specifications, and see that the drawings are in conformity with each other and with all the specifications.

(2) Check all figures and dimensions on plans and details; check shop details as they are received to see that they do not conflict with scale drawings. Check all erection diagrams in order to recommend some other procedure in an emergency, should the necessity occur. Also see that the specifications, or special intentions, agree.

(3) Keep on the work, in an accessible location, special copies of all drawings, details and specifications, and carefully note on same any changes from original plans, so as to keep a complete record of the work as constructed.

(4) Familiarize yourself with all local conditions or ordinances affecting the work and see that same are rigidly adhered to.

(5) Make the acquaintance and keep in touch with the General Contractor and all sub-contractors.

(6) Establish diplomatic relations with adjoining property owners, or residents, and see that all their rights are respected by the contractors.

(7) Acquaint yourself with all traffic arrangements, whe-

ther regular or special, that may interfere in any way with the progress of the work.

(8) Secure full information concerning the conditions of steel work being fabricated in the mills or shops; also of any other materials that may be under the course of construction, and ascertain the names of all contractors, dates of orders and the probable date of shipment, and, if necessary, closely follow up same in order to secure proper delivery.

(9) Should any incomplete work be fabricated that will need attention and correction at the site, carefully look out for and see that all corrections are made before same is incorporated in the structure.

(10) Keep a record of the arrival of all materials. The contractor's record should be sufficient, if suitable; but should be carefully checked. Strive to anticipate any shortage of material and use all available facilities to hasten delivery; also arrange for the proper storage of same on the site.

(11) Try to anticipate the need of detail drawings and notify the engineer or architect regarding same.

(12) Study the progress of the work and try to determine whether it will be completed in the specified time, and, if in your opinion it will not be finished as specified, endeavor to secure such additions to force and equipment as to secure completion within the allotted time.

(13) See that the company's photographer is informed as to the progress of the work, and that "progress photographs" are taken at least every ten days.

(14) Keep a daily record of the force employed and the distribution of labor in such a manner that will clearly show the progress of the work, and also of all equipment in use, at all times.

(15) When "unit prices" are called for, make a careful report of the cost of all material and labor which are included in same, separate from each other.

(16) Make careful preparations so that the erection may proceed rapidly and that the period of any disturbance or delay may be reduced to a minimum.

(17) See that all piping or sleeves for same are built through walls and that all other piping conduits, etc., are in place before any floors are laid or masonry built; also see that all chases or recesses are left in walls to receive piping, etc.

(18) Keep in close touch with the engineer or architect and consult with them frequently as to the interpretation of all drawings or specifications.

(19) Exercise a constant supervision of any sheet piling, underpinning, or forms for concrete, or any other falsework or temporary structure, and see that same is properly maintained, and not removed until all masonry is set.

(20) Carefully observe surface and sub-surface conditions, and see that all excavations are shored or sheet-piled where necessary. If surface drains are needed, see that same are installed in advance of masonry. Be sure that all waterproofing is thoroughly jointed and lapped. Do not allow back-filling against green walls, unless same are braced; also see that all back-fill is well puddled.

(21) See that all machinery and boiler foundations are built true to detail. See that all stone or terra cotta work is perfect before same is placed in the work; also see that all brick or other mason work is laid and anchored as specified. Be careful and see that all concrete work, whether reinforced or otherwise, is constructed as specified in all particulars.

(22) See that all furring is in place and firmly secured before work is started and that sufficient time is given to dry out between coats, and that a proper backing is prepared for all tile and marble work.

(23) See that all work is carefully aligned and accurately fitted. Closely watch all riveting and see that same is tight; also closely watch the painting of all work.

(24) Carefully examine all work before same is installed; see that all framing is accurately made and anchored and all roughing and furring is built in. All finished work should be

carefully inspected as to design, finish, etc.; if necessary, make "mill inspection"; trim must not be applied until plastering is dry. See that all hardware is properly attached, including that to metal-covered work.

(25) See that all flashings are carefully built in.

(26) See that the grades of pipes are uniform, properly supported and that all plumbing work conforms with the requirements of the local authorities. See that all joints are carefully made and are water-tight.

(27) Keep careful account of any extra work, in order to be able to explain satisfactorily, and check all extras. Keep a daily record of the progress of the work, including force

employed, in a separate field book for each job. Note in same if any disputes arise, their settlement; also variations, if any, from the plans or specifications; at completion of the work, correct all plans and specifications to agree with work, as constructed, and make a final report showing costs, where required.

(28) A careful and complete record in detail must be kept of the cost of all alteration or repair work, wherever work of this nature occurs in any part of the construction. Also a detail of the cost to reproduce any and all structures that may be torn down, removed or otherwise destroyed shall be kept; and a report in full shall be sent immediately to the engineer.

The Proposed Second Narrows Bridge at Vancouver

THIS structure, so long contemplated, is now in a fair way of being erected. As the name implies, the bridge is to cross Burrard Inlet at the Second Narrows, three miles from the First Narrows at the entrance to the inlet.

The bridge is to have a swing span 581 ft. 6 in. in length between bearings, longer than any swing bridge yet built, two main spans 232 feet centre to centre of bearings, with 29 spans of steel trestling for the railway and 15 spans also of steel trestling for the roadway and sidewalk on the north side. The south approach to the end of the swing span for the railway is 250 feet in length and the roadway is 180 feet, with clear spans of 108 feet over the Canadian Pacific Railway. The total length of bridging for the railway will be 3,449 feet and for the roadway, 2,364 feet.

There is to be a single track for a steam railway, a roadway of 37 feet 5½ inches between curbs, with two central tracks for electric cars and an 8-foot footway bracketed out from the eastern trusses. The width of the bridge from centre to centre of trusses will be 59 feet 6 inches.

On the south side of the Narrows the ground formation is a soft sandstone and rock, extending out to mid-channel and dipping under the gravel and detrital formation on the north side where Seymour Creek has been forming a delta. The depth of water in mid-channel is 96 feet 6 inches at ordinary spring tides, extreme tides running up to 100 feet nearly.

The swing span is to be carried by four wrought steel cylinders braced together and filled with concrete, spaced 49 feet centres in both directions. When closed the southern end will rest on a pair of wrought steel braced columns re-strung on a pair of cylinders spaced 59 feet 6 inches centres and on the northern end on braced wrought steel columns re-strung on the ends of a solid pier extending the full width of the bridge. The piers north of mid-channel will be founded on the coarse gravel overlying the rock, that nearest the channel being carried down below the level of the bottom of the channel. The north arm of the swing will be placed over the fairway which is situated south of mid-channel. The bridge is to give a clear headway of 45 feet above high water of ordinary spring tides and a clear waterway on each side of the supporting pier of 225 feet measured square to the line of the span in the open position.

The bridge crosses the channel at an angle of 75 deg. to the average direction of the ebb and flood currents. The line of the swing when open follows the

contour of the bed of the Narrows, and affords a minimum depth of 35 feet at low water through the south opening. The bridge dolphins will consist of six cylinders on the line of the span when opened, with heavy timber fendering.

The swing span is to be electrically operated, with hand gear for standby. The locking of the bridge closed and the opening and closing of the gates are also electrically controlled, as well as the signals for traffic and navigation—the whole controlled from an operating cabin in the usual manner.

The trusses of the swing and main spans are to be of the Warren type with vertical suspenders. The north approach is to be carried on steel braced trestles spaced longitudinally 29 feet centres and 43 feet 6 inch centres between the bents of the adjoining trestles. Transversely the bents supporting the steam track will be spaced 8 feet centres at the top with a batter to the bases of 1 in 4½. The bents for roadways and electric car tracks and footway will be vertical and spaced 26 feet centres, all supported on concrete foundations.

A series of borings made on the tide flats on the north side on the proposed line were sunk to a maximum depth of 160 feet showing alternate layers of coarse and fine gravel. On the south side the rock formation gives a good foundation.

The design is for a complete structure to span the inlet. The south approach is partly in cutting and embankment and from the end of the trestles on the north side by banking to ground level.

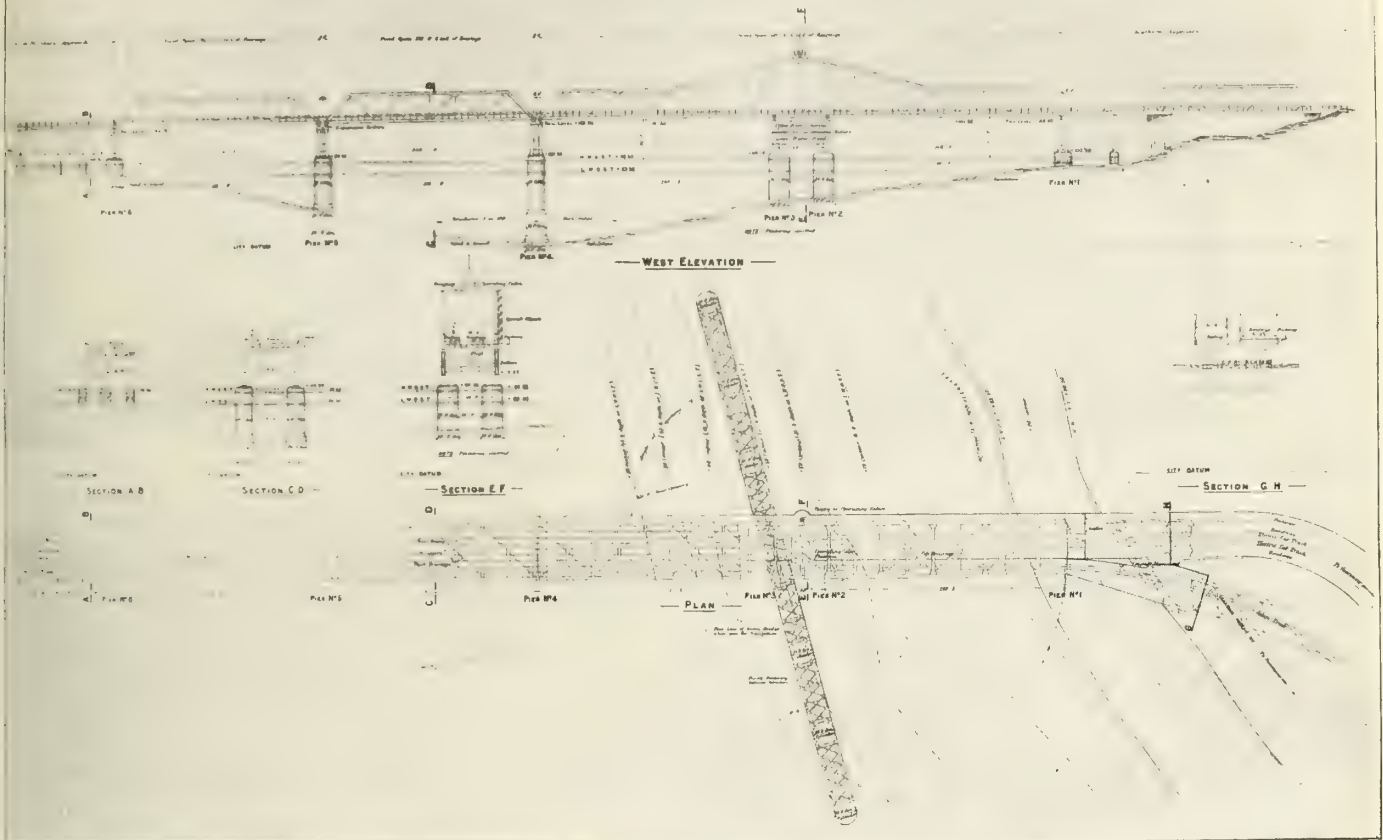
The bridge will give access to Vancouver from North Vancouver to the Pacific Great Eastern Railway. The electric car interurban traffic is fully provided for, with ample traffic road and footway accommodation.

The bridge is designed according to the requirements of the Dominion Department of Railways & Canals, and the work will be manufactured in conformity with the specifications of the Department.

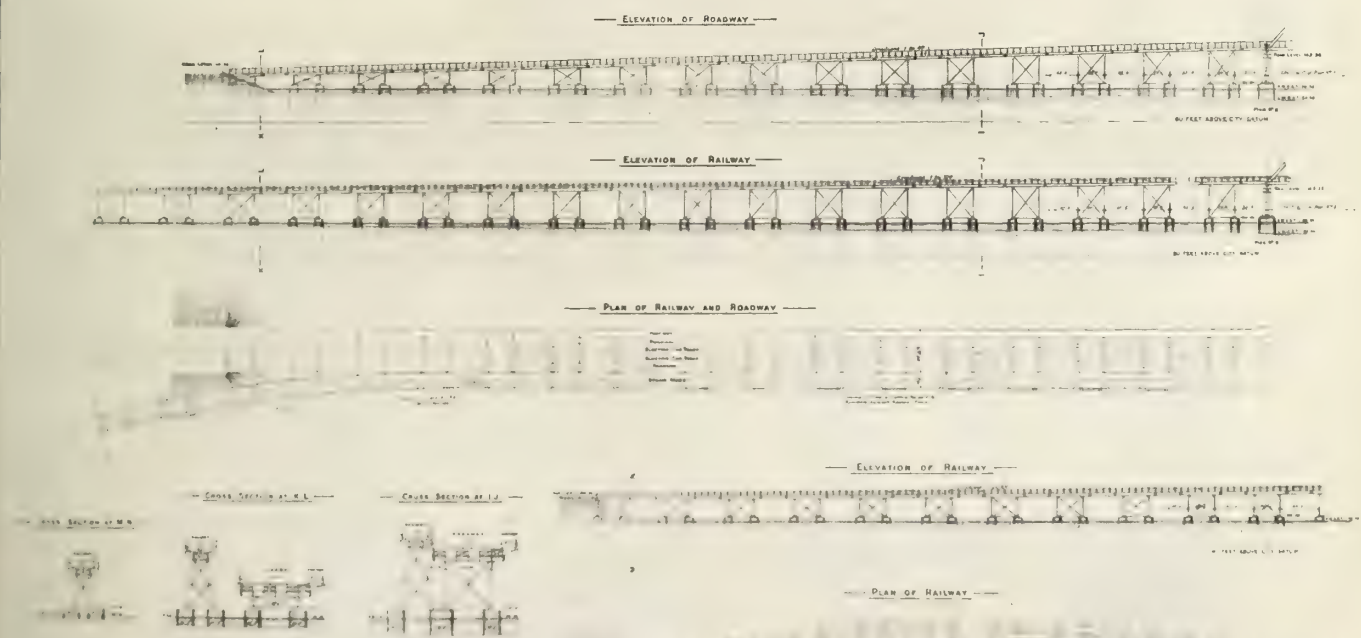
The Engineers for the bridge are Sir John Wolfe Barry, Lyster & Partners, of London, Eng., with whom is associated the Vancouver firm of Cleveland & Cameron.

Messrs. John R. Freeman, W. R. Burr and Alfred Noble, consulting engineers in connection with the Catskill Aqueduct, have asked that their salaries be reduced from \$6,000 to \$3,000 per annum each, on the ground that the bulk of their work has been completed. The unusual request has been granted.

— SECOND NARROWS BRIDGE — GENERAL DRAWING OF BRIDGE AND APPROACH VIADUCTS —



— SECOND NARROWS BRIDGE — NORTH APPROACH VIADUCTS. —
GENERAL DRAWING.





Suspension bridge over Kootenay River. From the South bank.

New Suspension Bridge Spanning the Kootenay River

THE thriving colony of Brilliant, situated at the confluence of the Columbia and Kootenay Rivers, in the West Kootenay District, comprises the principal settlement of the Doukhobor society in British Columbia, most of the villages* in the settlement being separated from the line of the Canadian Pacific Railway by the two rivers mentioned.

Owing to the rapid development of the district in the last few years, the need of a substantial bridge for the purpose of affording communication with the surrounding country became imperative, and it was de-

cided recently to erect a structure of the suspension type to span the Kootenay River at this point. An excellent idea of the class of bridge erected may be gathered from the views accompanying this article, the work having been designed by and constructed under the supervision of Mr. J. R. Grant, of the firm of Cartwright, Matheson & Company, consulting engineers, Vancouver, and built by the Doukhobor society, with the financial assistance of the provincial government. The cables, towers and anchorages were designed for a total live load of 155 tons, while the trusses have been designed for a live load of 60 lbs. per square foot for the chords and 80 lbs. per square foot for the

* A Doukhobor village consists of two dwelling houses, with out-houses, in which reside from six to ten families.



Suspension bridge over Kootenay River. From the C.P.R. tracks on the North side.

diagonals, the floor being designed to carry the weight of a 26,000-lb. traction engine, several of which are owned by the society. The bridge has a clearance of 45 feet above high water. The span is 331 feet from centre to centre of towers. Below the site of the bridge the river has a width of over 500 feet. The structure itself has a clear width of 16 feet, and the roadway consists of 3-inch plank on nine lines of 3 x 14-in. Douglas fir joists, the floor beams being spaced 11 ft. 6 in. from centre to centre and built up of two 12-in. channels at 20½ lbs., placed 1½ in. back to back, 1¼-in. diameter hanger rods passing between them. The steel stiffening trusses have a depth of 9 feet, the top and bottom chords being built up of two angles 6 x 6 x 7/16 ins., while the diagonals are each of two angles 3½ x 3 x 5/16 ins. The top chords are supported laterally at each floor beam by knee braces, consisting of two angles 3½ x 3 x 5/16-in. The bridge is braced laterally by round rods varying from one inch diameter plain rods to one and one-eighth inch diameter upset rods, and by guy cables of 1¾-inch galvanized plow steel wire rope with wire centre, attached at points 57-ft. 6-in. on each side of the centre of the bridge. Each of the main suspension cables consists of four 2-in. galvanized plow steel wire ropes, each composed of seven strands of nineteen wires. The sag is 37 feet and the cables are cradled one inch in 12 inches, giving a width centre to centre of saddles of

26 ft. 10 in. The hanger rods are attached by cotter pins through pairs of bent plates, which grip the ropes firmly together. Each saddle, consisting of a cast iron seat, with grooves for each rope, moves on a nest of eight 4-in. rollers on a steel base plate, the whole saddle being protected from the weather by a light metal cover. Each cable is attached by a steel socket of two 2¼-in. diameter bars which are anchored in solid rock. The top of the towers is 46 feet above the roadway and the two shafts forming a single tower are braced by cross girders with deep knee braces. These towers are constructed of concrete, mixed in the proportion of one portion of cement to six of aggregate, and are reinforced with plain round rods. The piers are constructed of rubble concrete mixed in the proportion of one part of cement to seven and one-half of aggregate and contain between 40 and 50 per cent. of large stones.

The difficulties encountered during the course of construction will be appreciated when it is explained that all the laborers employed were members of the Doukhor society, who were unaccustomed to work of this character, and, with few exceptions, unfamiliar with the English language. On account of these conditions Mr. A. M. Truesdell, the resident engineer of the work, was compelled to remain constantly at the site during the entire progress of the operations, most of his instructions being by means of an interpreter.

Avoidable Defects in Concrete Paving

By Frank F. Rogers

CONCRETE can no longer be regarded as in the experimental stage as a surfacing material for county roads and on certain streets for city and village pavements. It has long been accepted as the most suitable material for the foundation of pavements for city streets, no matter what material is used for the wearing surface. There has been a great deal of discussion, however, as to its suitability for a paving material when used for both foundation and wearing surface.

Unfortunately most of what has been written both for and against concrete for road surfaces has come from persons directly or indirectly interested in the sale of cement, or on the contrary, interested in the promotion or sale of some other materials for surfacing both city pavements and country roads. Under such circumstances, no matter how honest the writer may attempt to be, his arguments and conclusions almost invariably coincide with his interests. We have Scripture for it, that "where the treasure is there will the heart be also."

The last five years have seen an immense yardage of concrete pavements laid in the cities and small towns of the country and a rather large mileage of concrete laid on country highways. Michigan, Wisconsin, Illinois and Iowa are the states which seem to have been most active in this work.

The writer has observed pavements built of this material in many cities, and has seen all the concrete roadways that have been built in Michigan, possibly 75 miles in all. A paper giving the results of a rather minute study of some thirty miles of the concrete roadways in Wayne County, Mich., was prepared by him for the American Road Congress recently held at Detroit, but as this paper has been published in full in

most of the engineering journals no further reference will be made to it at this time. As to the pavements, it must be said that a few of them are without defects, but most of these can be traced to the following causes: (a) Too lean a mix; (b) A poor aggregate; (c) Poor foundation, including inadequate drainage; (d) Lack of suitable expansion joints properly spaced. And it should be added that about all of the observed defects in concrete roadways can be traced to one or more of the above causes.

Look Out For Lean Mix

A large percentage of the defects in city and small town concrete pavements may be charged to a lean mix, especially where two-course concrete has been laid. There has been much talk about satisfactory pavements of this kind at a cost from 75 cts. to 80 cts. per sq. yd. Any attempt to build concrete pavements or roadways at these prices is a sure bid for failure. Under favorable conditions and with careful workmanship the writer believes that the two-course pavement can be made a success. If so the top layer must be put on before the bottom layer has had time to take the initial set, and the mix should not be leaner than 1:2½:5 for the base, nor than 1:2:3 for the top. I would prefer a one-course concrete with a 1:2:3½ mix, taking great care in the selection of the aggregate both as to hardness and toughness of the crushed rock or pebbles, and in the proper grading of both the coarse and the fine aggregate so that the utmost possible density would be secured.

Experience thus far has convinced the writer that it is much easier to secure a satisfactory cement than to secure a suitable aggregate. Results in Wayne County seem to favor washed pebbles and sand rather than crushed cobbles for aggregate. This is rather

hard to account for when one considers that the pebbles represent about the same variety and character of rocks that we get in our cobbles. It is quite possible that a better gradation from fine to coarse is secured with the pebbles, thus making a denser material. No matter what the theory, there can be no question that the pebble concrete makes the most durable surface and one which wears more evenly than others.

In the accelerated tests on two sections of concrete and two sections of brick made at Detroit during the recent Road Congress, the concrete in which Wisconsin granite, a rock as hard and tough as most traps, was used for the coarse aggregate, wore much better than the section where washed pebbles were used. It should be stated, however, that the price of Wisconsin granite delivered in Michigan is too high to allow it to be extensively used as an aggregate either for concrete pavements or roadways. The only materials that are commercially available at prices that can be considered are washed pebbles, crushed cobbles and limestone. So far the latter has been used but little for road purposes, but I am of the opinion that the best grades of lime rock are worth considering in this connection, especially on the secondary roads. The limestone (which is a dolomite) would at least wear evenly which is not true of the cobbles owing to the varying degrees of hardness and toughness in the different varieties of rocks found among the cobbles in our state.

Watch the Foundation

To avoid cracks the foundation must be absolutely stable and free from water at all seasons of the year. Where old travelled highways can be used for the foundation with only enough changes of surface to make a smooth sub-grade, the conditions are ideal. Where such conditions are found in Wayne County long stretches of roadway 15 ft. and 16 ft. wide may be seen, perfectly free from longitudinal cracks. On the other hand any cut or fill more than 1 ft. or 2 ft. in depth is almost sure to produce longitudinal cracks in the concrete, unless it is very narrow.

Experience has proved that from 25 ft. to 33 ft. is a suitable spacing for transverse joints. By way of experiment a 150-ft. stretch of 16-ft. roadway was laid on Michigan Ave., Wayne County, this year without expansion joints of any kind. Before the road was opened to traffic nature had supplied the transverse joints spaced from 18 ft. to 26 ft. with one extra thrown in for good measure.

Any kind of crack except the expansion joints in a concrete roadway is some reflection on the design, workmanship, or material. There is no doubt that if all the knowledge we now have on this subject were utilized in design and construction, pavements and roadways of this material could be laid that would remain almost free from the defects named. There is some question, however, if to do so would not make the expense of the pavement or roadway so high as to be practically prohibitive. So far the cracks that have been found are not more difficult to handle than the expansion joints and apparently are not much more objectionable except for their unsightly appearance when repaired. However, if they should eventually become too numerous they would necessarily cause the destruction of the pavement or roadway.

The waterworks plants of Canada represent a cost of \$95,566,496, according to figures compiled by the Commission of Conservation, Ottawa.

Permanency in Modern Road Building

By Iverson C. Wells*

THERE are two materials that make for permanent roads—granite block and vitrified clay brick. Either one of these materials is durable and wherever you see a road that has withstood heavy traffic conditions for years you will find that one or the other has entered into its construction. Roads of clay brick, built five hundred years ago in Holland, are still doing service today. Streets paved with clay brick in London three hundred years ago are still carrying the burden of the heavy traffic of the world's greatest metropolis. There are permanent roads,—a highway that lasts only from two or three years is not a permanent highway, and yet the country is streaked with miles of just such roads because of a mistaken idea of economy.

In Cleveland, Ohio, and Cuyahoga County, the commonwealth in which Cleveland is located, there are



North Woodland Road, Cuyahoga County, Ohio. Laid in 1906. Fifteen feet wide, broken stone curbs, cement filler, concrete base.

several hundred miles of vitrified brick highways. Some of these were built more than a quarter of a century ago, but because they were constructed of permanent material they have not cost the taxpayers one cent in repairs and are good for many years to come. In Terra Haute, Ind., there are brick-paved streets that were constructed more than a quarter of a century ago and not one cent of repairs has been placed on them. They are as good today as they were when they were laid and they will continue to be of service for many years to come.

Vitrified brick is artificial granite. Man converts clay into this artificial granite by the same process that nature uses in making its product—by the application of intense heat, only he accomplishes his work in hours where nature has taken thousands of years. Vitrified brick, being cheap, durable and obtainable almost anywhere, is a popular material.

While vitrified paving brick is a most durable road

*Of the National Paving Brick Manufacturers' Association.

material, it must be used properly. Even a street or road constructed of Bessemer steel would give way if it were not properly laid. Poorly constructed brick streets or highways are not giving the taxpayer the full value of his investment. Built right, a brick street is as smooth as sheet asphalt, and it improves in this quality as the years roll by. The streets of Cleveland, some of the most exclusive boulevards being of brick, are proof positive of this statement. Properly constructed, a brick street is sanitary, is no noisier than others and has the advantage of being permanent.

There is but one method recognized by the National Paving Brick Manufacturers' Association for the construction of a No. 1 brick street or highway. Most of Cleveland's streets and the miles of highway in Cuyahoga County are built under the specifications indorsed by this Association. Briefly stated, this form of construction calls for—first of all—proper drainage for the roadbed. The roadbed must be rolled with a heavy steam roller. On top of this, six inches of concrete is laid and permitted to harden. A cushion of sand is

placed on the concrete and this is well rolled to form a smooth base for the brick. On top of this the vitrified brick are laid and a cement filler, composed of one part Portland cement and one part fine, sharp sand, is poured between the interstices. On each side of the street expansion joints are placed and a curbing of either stone or concrete. In highway construction, four inches of concrete usually forms the base, as the traffic conditions on the country roads are not as severe as in the cities.

The U. S. Government has indorsed this form of construction and used it exclusively in its road construction in Panama. The authorities will build several miles of vitrified brick road in Ohio as a part of the great national highway system and as a model for similar construction work.

Contrary to the popular idea, brick-paved streets cost little more than, and quite often not so much as, the best constructed streets or highways of other materials. They have the economical merit of permanency and freedom from repairs.

Suggestions for the Utilization of Granite Block Pavements

By R. H. Gillespie, Chief Engineer of Sewers and Highways, New York

STONE in many forms has been used for pavements from the earliest times. The old Roman roads were constructed of solid masonry, in many cases as much as three feet in depth, consisting of irregular shaped stones with interstices carefully filled with smaller stones, and the surface finished smooth and true. These roads were wasteful of material but remarkable for their durability and excessive cost.

The earliest pavements laid in this country were of the cobblestone variety, consisting of bank or water cobbles, varying from four to nine inches in diameter, embedded in earth, attempts being made to lay the cobbles to a uniform surface. This style of pavement, while cheap, was remarkable for the noise produced by traffic passing over it, and it was also very severe on draft animals owing to the constant jar from the load hauled.

Following cobblestones came what is known as the Belgian block. This type of pavement was a marked improvement over the cobblestone, and many miles of it were laid in New York City and vicinity. The blocks were usually of trap rock quarried along the west bank of the Hudson river, and in size were from six to seven inches square on top, about seven inches in depth, with a bottom dimension slightly less than the top. They were laid without foundation other than a sand bed and joints. While Belgian block was an improvement on the cobblestone, still it was open to many similar objections. Like the cobble it was very noisy and severe on animals, on account of its roughness as well as offering poor foothold, partly on account of the shape of the block and partly on account of the smooth glass-like surface of the individual blocks when worn by traffic.

Following the Belgian block, came the "specification" Belgian, which differed only in that the blocks were oblong, similar in shape to the present day granite blocks, and were open to the same objections as the

square block, except that they afforded a better foothold for horses. Next came the granite block, which combined the good qualities of the cobble and Belgian blocks, with desirable qualities of its own. On January 1, 1913, there existed in the City of New York 312 miles of granite block pavement. It is perhaps reasonable to believe that this type of pavement in its present improved form—and as it is likely to be further improved in the future—will increase rather than diminish in popularity. Its noisiness, which has been its chief objection in the past, is materially reduced in the improved block, and in view of the rapid increase in the use of rubber-tired vehicles this objection, it is predicted, will soon disappear entirely. The earlier pavements of the granite block type in New York City and vicinity were laid on a sand foundation varying from 1½ to 3 inches in depth; the blocks were from eight to twelve inches in length, 3½ to 4½ inches in width, and seven to eight inches in depth, so dressed as to lay joints not exceeding one inch. Later specifications reduced the maximum width of joint to ¾ of an inch. The pavement was then sanded, rammed and sanded again, and after all vertical joints were broomed full, the street was opened to traffic. In the early '90's a concrete foundation was provided for streets of particularly heavy traffic. The dimensions of the blocks, however, remained the same. On the concrete foundation was placed a sand cushion from one to two inches in thickness, and the blocks laid with all vertical joints filled with hot tar and gravel.

Early in 1911 the engineers of the various Boroughs of the city revised the specifications to provide for the so-called improved block. There was no concerted action, however, in this respect. Manhattan specified a block 7 to 11 inches long, 3½ to 4½ inches wide and 4¾ to 5¼ inches deep, dressed to lay ⅔ inch joints. The Bronx block was 6 to 9 inches long, 3½ to 4½ inches wide, and 5 to 5½ inches deep, dressed to lay ½-inch joints, while the Brooklyn block did not agree with either, with the result that the quarrymen were at

sea and hesitated to get out large quantities of blocks in advance of actual orders.

Manhattan laid its first improved block pavement on Fourth Avenue, between 8th Street and 23rd Street. The Bronx on Teasdale Place, between Boston Road and Cauldwell Avenue—the former being a street of heavy commercial traffic, the latter a street of light traffic but with a 9.6 per cent. gradient. Each was laid under the specification peculiar to the respective Boroughs as to the size of blocks and dressing. The vertical joints of the Fourth Avenue pavement were filled with hot paving cement and coarse sand, and cost \$3.55 per square yard including foundation; Teasdale Place with Portland cement grout mixed in proportion of one part cement and two parts Cow Bay sand, and cost \$4.85 per square yard including foundation. The high price on this contract was probably due to the small called for (725 square yards). During 1912, large areas of this type of pavement were laid under the standard specifications for improved block. The reports for the year ending December 31, 1912, for Manhattan and The Bronx indicate these areas as follows:

Manhattan—Improved Granite Block	156,000 sq. yds. (7.52 miles)
Bronx—Improved Granite Block	54,975 sq. yds. (2.22 miles)
Manhattan—Special Imp. Granite Block ...	103,000 sq. yds. (4.17 miles)

the latter differing from the former in that the joints are $\frac{3}{8}$ of an inch instead of $\frac{1}{2}$ inch. All the Bronx improved granite pavements have joints grouted with Portland cement mortar, and all those laid in Manhattan are laid with paving cement and sand. The average cost, including a 6-inch concrete base, in Manhattan has been about \$4.50 per square yard and in the Bronx \$4.18 per square yard. Contracts are now in force or in preparation for extensive areas of this type of pavement.

Recently a granite pavement was laid in the Brooklyn Navy Yard similar to the Durax and Kleinpflaster block pavements of England and Germany. The blocks were manufactured in Salisbury, North Carolina, with an imported Sett making machine and were smooth and uniformly $2\frac{3}{4} \times 3\frac{1}{2}$ head dimensions. On account of this uniformity in size, the laying in concentric circles or segments as practiced in Europe had to be abandoned, and the blocks laid in straight lines or in arcs of circles of long radii. The pavement was laid on concrete with a cushion of stone chips $\frac{1}{2}$ -in. in depth, the joints were filled with the same material and poured with hot paving pitch. While this type of pavement has been used extensively in Europe and has given excellent results under heavy traffic conditions, it is believed that though it may be an economical pavement abroad, owing to the lack of quarries furnishing suitable stone and the necessity of making use of small fragments that cannot be used for other purposes, as well as the low cost of labor, that in this country where there are many suitable quarries, and where labor is very costly and entirely inexperienced in laying this type of pavement, the materially higher cost, as compared with the cost of improved blocks as at present laid, would hardly seem justified.

In 1908 the suggestion was made to the Bronx authorities as to the advisability of making use of the old granite blocks by splitting and redressing them. The scheme met with approval and a contract was gotten out for repaving Webster Avenue from 165th Street to 171st Street, with the result that an excellent pavement was obtained at very low cost. There has been practically no maintenance cost since the contract was completed, and the pavement at the present time is in very satisfactory condition. The blocks laid on sand,

under the old specifications, are in most cases fully up to the length specified; in fact, a considerable proportion run from 12 to 14 inches in length and are rarely less than 7 inches in depth. The splitting and dressing consists in breaking the blocks running in length from 11 inches up, in two, using the broken face as the head and dressing the ends and sides to lay $\frac{1}{2}$ inch joints. The finished blocks are from $6\frac{1}{2}$ to 8 inches long, $3\frac{1}{2}$ to $4\frac{1}{2}$ inches wide, and $5\frac{1}{2}$ to $6\frac{1}{2}$ inches deep. Blocks shorter in length than 11 inches are reheaded where necessary, dressed to lay the required joints, and as a rule are used along the street railway tracks. As the blocks are dressed they are piled along the sidewalk until the concrete is in readiness for the pavement. The blocks are laid in the usual manner, in rows, at right angles to the curb line on a 6-inch 1:3:6 concrete foundation with a $1\frac{1}{2}$ -inch sand cushion. Up to November, 1913, 207,150 square yards, or 7.96 miles of this type of pavement had been laid in the Borough of The Bronx, all of it with vertical joints filled with Portland cement grout, at an average cost of \$1.21 per square yard, exclusive of concrete base, as compared with an average cost of \$3.20 per square yard for new improved granite block exclusive of foundation.

During the past four years all the improved and redressed granite pavements in the Bronx have been laid with joints filled with Portland cement grout, while in Manhattan and the other Boroughs they have been filled for the most part with paving cement or paving cement and gravel. The writer is of the opinion that under like conditions a thoroughly and well grouted granite pavement will give better results than one where paving cement and gravel are used. It is more easily cleaned, is apt to shed water more readily, is slightly smoother, and there is less tendency for the blocks to turtle back. There is one temporary but serious objection, while it lasts, to the grouted pavements, that should be noted, viz., the interference and inconvenience to business interests along the line of the street due to the time that the street must be kept free from traffic while awaiting the setting of the grout. This time should be, under the most favorable conditions, not less than one week. Still it is quite practicable to pave half a street at a time and thus to some extent minimize this objection.

For streets which are called upon to accommodate a large amount of heavy commercial traffic, the pavement of the granite block type, whether new or redressed, whether grouted or tarred, under the present specifications, will prove more economical and generally satisfactory than pavements of perhaps any other type on account of its adaptability to any grades, its non-slipperiness, its sanitariness, and its durability. Its chief objection, noisiness, as stated before, is eliminated to some extent by the use of a smoother block, and, further, by the advent and increasing use of rubber tired motor for iron-shod, horse-drawn vehicles.

A concrete hardening material now being introduced in the United States contains 95 per cent. iron dust, which is mixed with cement for finishing the surface of concrete floors. From 15 lb. to 25 lb. of the material is mixed with 100 lb. of the cement while dry, and one part of this mixture to two parts of sand makes the slurry for the top coat, which varies from $\frac{1}{2}$ in. to 1 in. in thickness. It is said to make a hard and durable floor, which is waterproof and not slippery. The hardening material is used also to make new concrete adhere to old concrete in repair work.

Break in the Montreal Conduit and Method of Making Repairs*

A SERIOUS "blow-out" of a portion of the reinforced concrete conduit which conveys the municipal water supply of Montreal occurred on December 25, 1913, and until January 2, 1914, when the conduit was again successfully placed in service, the city was plunged into the confusion and distress incident to a partial water famine. An official report on the cause of the break and the general condition of the conduit is being prepared, at the instance of the proper city officials, by J. A. Jamieson and P. W. St. George. The gist of that report will be presented to our readers when it becomes available for editorial use. Pending the receipt of the report mentioned we have prepared the following statement relative to the failure of the conduit and to the methods employed in repairing it. The present article is based on information derived from various sources.

Section of Conduit.—Figure 1, herewith, shows a cross-sectional view of the concrete conduit which failed. Figure 2 is a diagrammatic cross-section showing the relative position of the old and new canals and the conduit.

The smaller canal shown in Fig. 2 was formerly used to conduct the water supply of the city from the St. Lawrence river. About five years ago the reinforced concrete conduit was built and since then the work of enlarging the first canal has been prosecuted at intervals. The new canal is to furnish water for power and industrial purposes. The primary cause of abandoning the old canal was that the water it carried was exposed to serious contamination.

The old canal had a width at the water line of 80 ft. and a depth of 8 ft. The old canal was widened to 140 ft. and its depth increased to 14 ft. under a contract awarded in 1910. Work on the canal widening was begun in 1877, long before the enclosed concrete conduit was thought of, but a change in plan soon led to the cessation of excavation operations and they were not resumed until after the concrete conduit was in use.

As shown in Fig. 1 the conduit is of the horseshoe type, the radius of the invert being 13 ft. The greatest inside height of the section is 7 ft. 3½ ins. and the greatest width is 9 ft. The inside width of the bottom segment is 7 ft. 2½ ins. The thickness of the concrete at the top and bottom is 8 in. and at the level of the greatest width of section it is 12 ins. The concrete is 1:2:5 mixture reinforced with No. 7 and No. 12, Birmingham gage, Clinton wire mesh, the larger strands being 4 ins. and the latter 12 ins. apart. The soil traversed by the conduit ranges from limestone to clay.

* Courtesy of Engineering and Contracting.

The stability of the latter soil is dependent upon its moisture content. Where the surrounding soil was unstable the reinforcement extends entirely around the conduit section. Where the foundation was stable the reinforcement was carried 1 ft. within the outer ends of the bottom segment of the section. The size of stone specified for this construction was up to 1½ ins. in greatest dimension for the portion below the greatest horizontal width of the section and up to ¾ ins. in the balance of the section. It was further specified that the wire cloth should not at any point be closer than 3 ins. to the inner surface of the conduit. The capacity of the conduit is 50,000,000 Imp. gals. per day. The length is 27,300 ft. and the grade 1 in 5,000. When

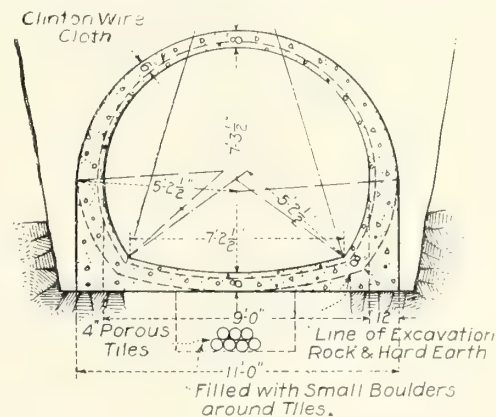


Fig. 1.—Typical cross-section of reinforced concrete conduit which failed.

carrying the normal flow the hydraulic grade line is only from 5 to 10 ft. above the top of the conduit.

The larger canal, shown in Fig. 2, was completed under a contract awarded in 1910, and almost as soon as this work was finished a further widening and deepening of the canal, to 174 ft. and 18 ft., respectively, was decided upon. This final enlargement of the canal section has been carried on by the Cook Construction Company. The new canal bottom is 5 ft. lower than the invert of the concrete conduit at the point where the accident occurred, and at that point the canal side slope is only 17 ft. from the conduit.

About the middle of December the contractor had about excavated the canal section to its full size at the point where the break in the conduit subsequently occurred. The excavation, which was in clay at this point, was made by means of a drag line machine which moved parallel to the canal. This excavating machine was a short distance from the conduit, the

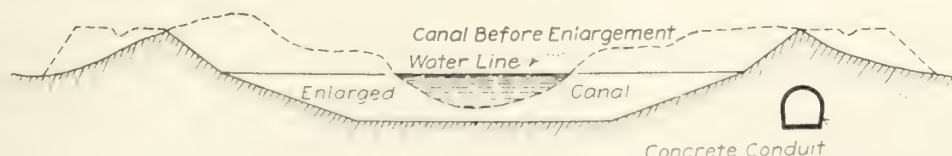


Fig. 2—Montreal Water Conduit—Sectional diagram showing relative positions of old canal and its first enlargement and the water supply conduit.

(The second enlargement of the canal, which was under way at the point where the blow-out occurred, is 4 ft. deeper and 34 ft. wider than largest canal above shown.)

conduit being between the scraper and the canal. The scraper was on about 5 ft. of spoil from the canal excavation. This made the depth of filling over the conduit about 10 ft. At the time mentioned it was noticed that the conduit was leaking, so excavation operations were suspended. The leaking portion of the aqueduct was exposed and the cracks through which the leakage occurred were calked. Stone and sand for filling were also deposited back of a line of sheet piling set between conduit and canal. This repair work was completed two days before the blow-out occurred but, as developments indicate, it was of no avail.

A strip of the conduit concrete 60 ft. long and 2 ft. wide, on the canal side, gave way on the evening of Christmas Day. The conduit was, of course, soon emptied and Montreal was without an adequate supply of water until the evening of January 2. The conduit head gates were closed as soon as the break occurred.

Method of Making Emergency Repairs

A local iron works was given a rush order to get out seven 18 ft. lengths of riveted steel pipe, 7 ft. in diameter and $\frac{1}{2}$ in. thick. While the pipe was being made the entire section of the conduit was torn out for the full length of the break. The bucket of the drag line excavator previously mentioned was used as a battering ram to break out the concrete. It took almost two days to clear away the portion mentioned.

The steel pipe was placed in the conduit in such a manner that it extended across the break and 32 ft. farther at each end. Adjacent sections of the pipe were bolted together by means of angle iron flanges, which were riveted to the inside of the pipe. The placing of these flanges inside instead of outside the pipe caused embarrassment later on, as will be described.

The entire length of lap between the concrete and the steel pipe was filled to form a seal. At the ends of the steel pipe bulkheads were laid up, between the pipe and conduit, of brick in bitumen. The remaining portion of the seal was made by concrete deposited around the pipe through holes drilled for that purpose through the top of the conduit. Use was also made of cement in bags, presumably for the outer ends of the lap, and of grout applied by the cement gun. An effort was made to hasten the setting of the concrete by introducing live steam into the conduit and by banking coke fires against the exposed portion of the pipe.

As soon as the seal was completed as described the head gates were opened and it was at once apparent that the repairs made were inadequate. Leaks occurred through the seal and also through the bolted flange joints which were provided with rubber gaskets. Since the bolts were inside the pipe it was necessary to empty the conduit in order to tighten them. Men entered the conduit through a manhole in the exposed portion of the pipe line and tightened up the bolts. The seal between pipe and conduit was also improved, and the new concrete, which was carefully placed, was given 24 hours in which to set before the gates were again opened. This time the repair was a success. Since the head gates were opened on the evening of January 2 the normal supply of water has been delivered through the conduit to the city.

While the municipal conduit was out of service the city was partially supplied with water through connections between the city mains and the mains of the distribution system of the Montreal Water and Power Company. About 30 per cent. of the normal supply was furnished in this manner. Some water was distributed by means of portable tanks on carts.

Safeguarding Heating Pipes

EVEN the comparatively low heat of hot air ducts, steam and hot water pipes is unsafe to trust without special safeguards, says the American Carpenter. It is a generally accepted fact that wood charred very slowly ignites below the temperatures required for ordinary charcoal.

A hot-air pipe can get too hot to touch comfortably: it must always be of metal. It is recommended not to place these inside of wood partitions at points nearer than eight feet from the furnace, to allow six inches between bare woodwork and the pipes, and in partitions or closets to enclose each in a tin pipe at least one inch larger than itself or to protect the nearest wood with a tin shield set out from the wood one and one-half inch from the pipe. Or the pipe can be encased in metal lath, plastered, provided there is seven-eighths of an inch of plaster outside the metal lath. On horizontal pipes, a clearance of three inches between wood and the protecting covering is recommended.

Steam and hot water pipes should be two inches from bare woodwork, or one inch from that with a metal shield, and be centered in a metal tube of one inch larger diameter where passing floors or partitions with a cap at the floor. Indirect radiator boxes or similar casings should be lined. To economize heat, steam and hot water pipes are frequently covered, but it is dangerous to apply a covering which can burn, and some of the trade articles have in the past been found to possess that danger. For economical reasons it is well to select one which is as little subject to disintegration from steam or water leakage as possible.

A register in the floor to heat one room from another below is an opening which directly violates the principle of preventing the upward passage of fire, and is therefore objectionable.

A Substitute for Cement

In Turkey, where cement is not used or hardly known, a substitute has been found that has met with rather good results when applied in exposed places, in filling crevices in water pipes, covering joints in stone floors, in fountains, and for numerous other purposes where cement would be required. The mixture is as satisfactory in water as in exposed places, but it must be allowed to become thoroughly dry before it is submerged. The mixture is slaked lime, linseed oil, and cotton fiber. Generally a hollowed-out stone is used, although a flat, hard surface will answer, and the process is started by pouring the oil on a handful of cotton, after which the lime is dusted in. It is then kneaded until the whole is thoroughly mixed and about the consistency of dough. The more it is kneaded the better it becomes. This compound has undergone a severe endurance test at this consulate. Two years ago the stone floor in the balcony on the north side of the house leaked in several places and rotted the woodwork supporting the balcony. The floor was finally taken up, new timber added, and the stone flags again put down. Between each stone this mixture was forced in and smoothed over the joints. It took several days for hardening, the oil spread out on the stones for about half an inch from each joint, leaving a slight mark, but the compound soon hardened like cement, and to-day the surface over the part where the stones are joined is as hard and smooth and water-tight as if cement had been used.

Economic Conduit Location

Diagram to Assist in Selecting Proper Type of Structure for Varying Topographical Conditions

EVERY conduit carrying water, unless located in a country of uniform topography, changes at certain points from one type of construction to another for the sake of economy and safety. Rarely does a conduit of any great length consist entirely of canal section. It changes to flumes, siphons, pipes, bridge flumes or tunnels as demanded by the prevailing conditions. The points of change are determined not only by the slope of the ground, material encountered and local conditions, but also by economic considerations. In a paper printed in the "Proceedings" of the American Society of Civil Engineers for December, 1913, Mr. C. E. Hickok explains a diagram, evolved by him, giving the equivalent lengths, from an economic standpoint, of various types of conduit.

Tunnel or Open Cut?

This diagram is so constructed that when a locating engineer comes to a point where he must decide whether to tunnel through a ridge or follow the grade around it with a canal, he measures the length of the

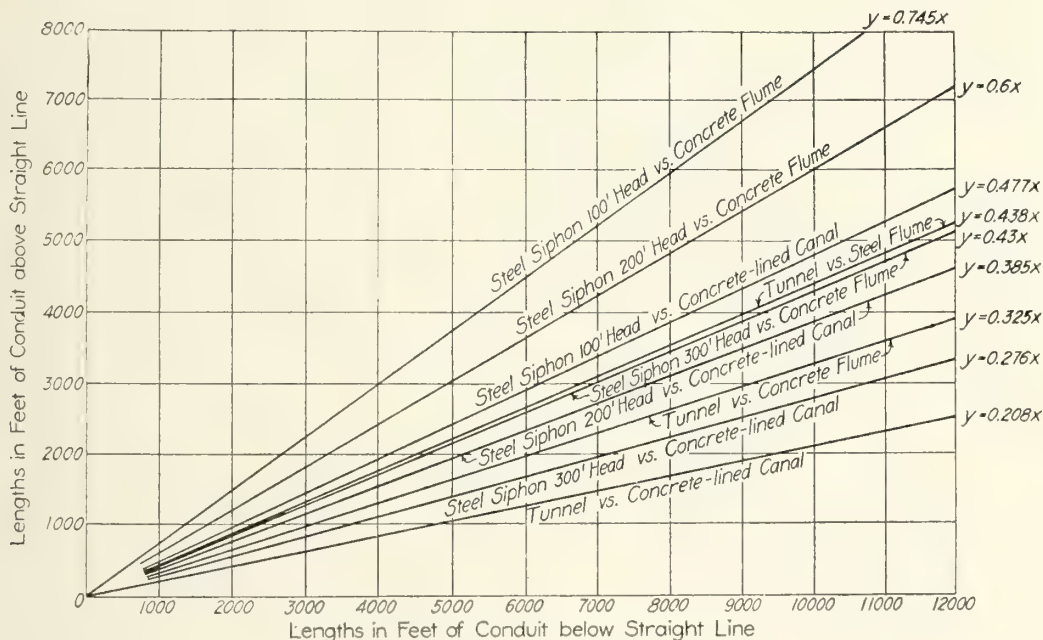
two possible routes and decides the question by means of the diagram. This not only eliminates loss of time but assures a comparison between the alternatives as to first cost, depreciation, head and evaporation and seepage loss values, interest, taxes, inspection and repairs.

Assume a case where the project under consideration is to be used for irrigation and hydro-electric purposes, and where the conduit has a capacity of 44.6 sec.-ft. and a slope of 0.1 per cent. Four types of conduit to be used are shown in the accompanying drawing.

Obviously each foot in length of conduit saved means a saving in head loss, as well as in evaporation and seepage losses. The value of this saving is ascertained in the following way, taking 1,000 ft. of conduit:

Head Loss.—A conduit 1,000 ft. long dissipates 1 ft. head. With a discharge of 44.6 sec.-ft. and 77 per cent. efficiency the horse-power value is $(1 \times 44.6 \times 62.5 \times 0.77)/550 = 3.9$ h.p. = 2.8 kw. Subtracting 10 per cent. for transmission and transformer losses, the result is 2.61 kw. at \$55 = \$143.50.

Evaporation Loss.—Assuming an evaporation of 5 ft. per annum $(8 \times 1000 \times 5.0)/43560 = 0.915$ acre-ft.



Equivalent Lengths of Various Conduits

BASED ON ESTIMATED ORIGINAL COST, ANNUAL EXPENSES AND PRODUCING VALUE OF ONE LINEAR FOOT OF CONDUIT

General Formula.— $y(C_s) = x(C_s) + (x - y)V + x(A_s) - y(A_s)$ where C_s = estimated cost per foot of conduit above line; A_s , estimated annual expense per foot of conduit above line capitalized at 10 per cent; C_b , estimated cost per foot of conduit below line; A_b , estimated annual expense per foot of conduit below line capitalized at 10 per cent; and V , estimated value of one foot of canal for power and irrigation purposes = \$2.53. Tunnel is credited with 10 cents per foot for saving in evaporation.

Type of conduit	Values Used	
	Original cost per ft.	Annual expenses per ft.
Tunnel	\$16.50	\$1.98
Concrete-lined canal	2.30	0.325
Concrete flume	4.28	0.579
48-in. steel siphon, 100-ft. head	5.88	0.961
48-in. steel siphon, 200-ft. head	7.46	1.211
48-in. steel siphon, 300-ft. head	10.64	1.714
Steel flume	5.58	0.887

Steel siphons are credited with \$1.10 per foot for saving in evaporation and seepage.

Example: 4000 ft. of concrete-lined canal can economically be replaced by less than 832 ft. of tunnel.

per year = 0.0025 acre-ft. per 24 hours = 0.00125 sec.-ft. with a head of 1500 ft.; $(0.00125 \times 1500 \times 62.5 \times 0.77)/550 = 0.162$ h.p. = 0.121 kw. Subtracting 10 per cent. for transmission and transformer losses, the result is 0.109 kw. at \$55 = \$6.

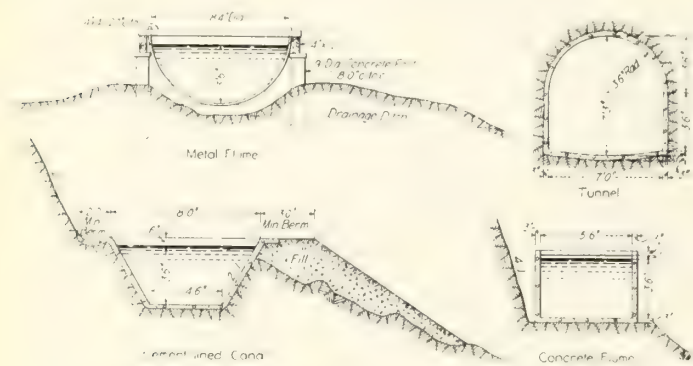
Seepage Loss.—From tests made by Messrs. Elwood Mead and B. A. Etcheverry at the University of California it is concluded that the rate of percolation through a 3-in. canal lining under a head of 3.5 ft. is about 0.0043 ft. per hour, or 0.103 per 24 hours; $(8 \times 100 \times 0.103)/43560 = 0.0188$ acre-ft. per 24 hours = 0.0094 sec.-ft., and $(0.0094 \times 1500 \times 62.5 \times 0.77)/550 = 1.23$ h.p. = 0.92 kw. Subtracting 10 per cent. the result is 0.828 kw. at \$55 = \$45.54.

The total annual power loss is $\$143.50 + 6 + 45.54 = \$195.04$. This amount capitalized at 10 per cent. is \$1,950.40, or \$1.95 per foot.

Irrigation Losses

The value 0.0025 acre-ft. in 24 hours from the foregoing = 0.00125 sec.-ft. = 0.0625 miner's inch. Assume 25 per cent. evaporation loss before delivery to consumer. Then 0.047 miner's inch at \$0.40 per day makes \$6.86 per year loss by evaporation.

The value 0.0188 acre-ft. per 24 hours, from the foregoing = 0.0094 sec.-ft. = 0.47 miner's inch. Sub-



Selected types of conduit used for establishing diagram.

tracting 25 per cent. loss gives 0.353 miner's inch, which at \$0.40 per day makes \$51.64 per year loss by seepage.

The total annual irrigation loss is $\$6.86 + 51.64 = \$58.50$. This amount capitalized at 10 per cent. is \$585 or \$0.585 per foot.

Resume

The power loss per foot is \$1.95; irrigation loss per foot, \$0.585; total loss per foot, \$2.535. The first cost and the annual charges of each type of conduit are next computed. The annual charges are taken as consisting of the following items: Interest, depreciation, taxes, inspection, and repairs. The annual charges of each conduit are capitalized at 10 per cent. and added to its first cost, which gives a figure having a real comparative value. For instance, the comparison between a lined canal and a concrete-lined tunnel is obtained as follows:

For concrete-lined canal the first cost per foot for excavation, 2 cu. yd. at \$0.36, is \$0.72; for concrete, 4.25 cu. ft. at \$10.20 per cubic yard, the cost is \$1.57. The total cost is \$2.29. The annual charges are: Interest at 10 per cent., \$0.23; depreciation at 2 per cent., \$0.046; taxes, \$0.019; inspection, \$0.01; repairs, \$0.02; or a total of \$0.325. Capitalized at 10 per cent. this

makes \$3.25, or together with \$2.29, the first cost, a total of \$5.54.

Concrete-Lined Tunnel

Excavation for concrete-lined tunnel, 2.25 cu. yd. at \$5.50, costs \$12.40; concrete and forms cost \$4.10, or a total of \$16.50. The annual charges are: Interest at 10 per cent., \$1.65; depreciation, at 1 per cent. \$0.165; taxes, \$0.137; inspection, \$0.01; repairs, \$0.02—total, \$1.982.

Capitalized at 10 per cent. this makes \$19.82, which, together with the first cost, gives a total of \$36.32.

It is evident if the conduit is shortened by building the tunnel that the first cost and the capitalized annual cost of the tunnel can exceed the first cost and the capitalized annual cost of the canal by an amount equal to the length of conduit saved multiplied by the loss value per foot of conduit.

In the case of a tunnel, the evaporation will be considerably lessened, thereby effecting an additional saving. If entirely eliminated, this saving would amount to 12.8 cents per foot as shown above. This was reduced to 10 cents and the first cost of tunnel credited with that amount.

In the same way any two types of conduit can be compared and the resulting straight-line equation obtained. The diagram, which is self-explanatory, shows the results.

In the case where a siphon crossing a gulch is compared with a canal or flume passing around the head of the gulch the cost of the siphon is credited with the saving in evaporation and seepage throughout its length, which in this case amounts to \$1.10 per foot.

A diagram of this sort cannot be relied on entirely in the location of a conduit, for there are local conditions on every piece of work which must be taken into account.—Engineering Record.

Quebec is the province in which Canada's production of asbestos is obtained. The shipments of asbestos in 1912 were 111,561 tons, valued at \$3,117,572, and of asbestic 24,740 tons, valued at \$19,707. The shipments in 1911 were 101,393 tons, valued at \$2,922,062, and of asbestic 26,021 tons, valued at \$21,046. The shipments in 1912 consisted of 5,662 tons of crude asbestos, valued at \$890,351, and 105,898 tons of mill stock, valued at \$2,227,221. Considerable quantities of crude and mill stock were held in manufacturers' hands at the end of the year, reports Mr. John McLeish, of the Department of Mines. Imports and manufactures of asbestos in 1912 were valued at \$461,449 and in 1911 \$319,815. Asbestos is an important fireproofing material. Its fibrous structure adapts it to a wide range of applications, from woven fabrics, such as theatre curtains and articles of clothing, to various forms of shingles, stucco, plaster, lumber and other building materials.

No bids for the comprehensive system of passenger subway rapid-transit lines authorized by the city council of Chicago, were received on January 5, when bids were to have been opened. The proposed work covers approximately 57 miles of route, of 135 miles of single track, costing \$96,000,000 for subway construction and \$34,000,000 for equipment. The nearest approach to a bid was an offer from W. H. Brown Construction Company, of London, offering to bid. Failure to attract bids is attributed to legislative handicaps, since the city cannot grant a franchise to exceed 20 years, and this must include the period of construction, from 3 to 5 years.

Waterproofing and Paint for Cement

Showing the Need for Special Treatment of this Material to Make it Suitable for Building Purposes

By George H. Gresser

THIS problem is of great interest to the engineer, architect, building contractor and owner, as it is only recently that cement and concrete are being used extensively in the construction of the modern building. Statistics show us that in the last fourteen years the production of cement has increased from three million barrels to thirty-five million barrels a year. The cause of this wonderful increase is due to the economy in manufacture and efficiency in concrete construction. But with all the advantages that cement has over other materials as to economy and strength, great care must be exercised in mixing and applying it to the finished surface, to get it uniform in color. Hollow blocks are the worst. It has been proven that they absorb moisture four to five per cent. of their own weight and retain this moisture for some time. Damp walls, as we all know well, are a detriment to health, and this factor is appreciated to such an extent that it has actually retarded the use of concrete in some instances.

Another argument against cement surfaces is that you do not get a uniform, pleasing color, but get varied shades of dull gray, very uninviting, that do not compare with the rich colors we find in terra cotta, granite, brick and decorated wood surfaces. There is no comparison, as cement surfaces, undecorated, give us a dreary, sometimes dirty, color that does not reflect the light, but absorbs it, and does not please the eye or appeal to the artistic temperament.

This little talk is not intended to condemn cement as a building material, but to advocate its use more than ever by improving over what is done in that line today. If we can add to its strength, economy and fireproofing features a decorative rich color, and at the same operation make it moisture and strictly waterproof, we certainly will have a building material that cannot be duplicated the world over.

But, you will say that we have it now to a certain degree. Some makers of cement add color while making the cement. Some engineers and architects specify waterproof powder or liquid to be added to the cement while mixing. This has not been proven a success, as anything of that nature added to cement decreases its tensile strength to such an extent that it is almost unsafe. It also affects the metal used for reinforcements. You cannot get the added color on waterproofing compounds mixed uniformly, and still have your different shades, and this very often deteriorates the concrete body and leaves a bad surface for any kind of painting in the future.

The question now arises: "What is the proper way to treat cement surfaces so as to get them decorated and waterproof?" This paper, as you can see, can be made a very lengthy one and requires careful study and research and would take up too much of your time. I am, therefore, going to touch upon the most important points only, and to give you the benefit of my experience along that line.

Washes, brushed on the finished surface of cement, made from waxes, gums, paraffin, etc., have been tried, but without complete success.

The first method used with paint was to first give the cement a wash with zinc sulphate and finish over

this wash with a white lead and linseed oil paint, but the paint does not hold up and it is now conceded that linseed oil paint is a failure for cement surfaces, as the alkaline salts in the cement attack and disintegrate it.

The last and most successful method and material used today, and conceded by chemists, engineers and concrete men to properly decorate and waterproof cement is a specially prepared paint, in several shades, to be brushed on by competent painters. The material contains no linseed oil or white lead and firmly adheres to the surface, filling small cracks and voids. Such a material is made by different manufacturers under various proprietary names, and requires two or three coats, which can be put on damp surfaces, but should be put on dry surfaces, and does not cover more than two hundred square feet to the gallon one coat. This material gives the dead flat finish of cement, and adds to the cost of your contract between 35 and 40 cents per square yard of surface painted. The smooth or rough surface of the cement finish has all to do with the cost of labor and material, as the stucco and rough cast surface requires more material and more brushing than the smooth troweled surfaces.

Inside Walls and Floors

Up to this point I have touched upon cement surfaces of the outside of buildings only. But we have inside walls and floors which must be decorated and made dampproof, and floors must be made so the cement does not dust off.

Inside cement walls are either in the damp or dry class. Damp walls, especially where there is a water pressure, such as along rivers and walls that get soaked with water after heavy rains, are a problem and should, if possible, be coated on the inside and outside with a paint made from asphaltum products and decorated afterward with regular cement coating. Inside cement walls that appear dry are not such a difficult problem and can be treated the same as ordinary walls.

In connection with the damp class of walls I will say that there are on the market to-day several paints recommended and made to apply on damp walls, but cannot say as to their success when used against water pressure.

Another class of surfaces are cement floors. We all know that when put to heavy wear they soon show defects, get slippery or throw off dust, especially where rich in cement and troweled to a granolithic surface. Giving the floor a cement wash will not answer for factories, shipping rooms or engine rooms. The acids in the lubricating oils attack the cement and destroy its bond. The texture of cement floors and the finish vary so much that we cannot make the same specifications for all of them. They must be tested with specially prepared paint and put on by some one who has made a special study of dampproofing and decorating cement surfaces.

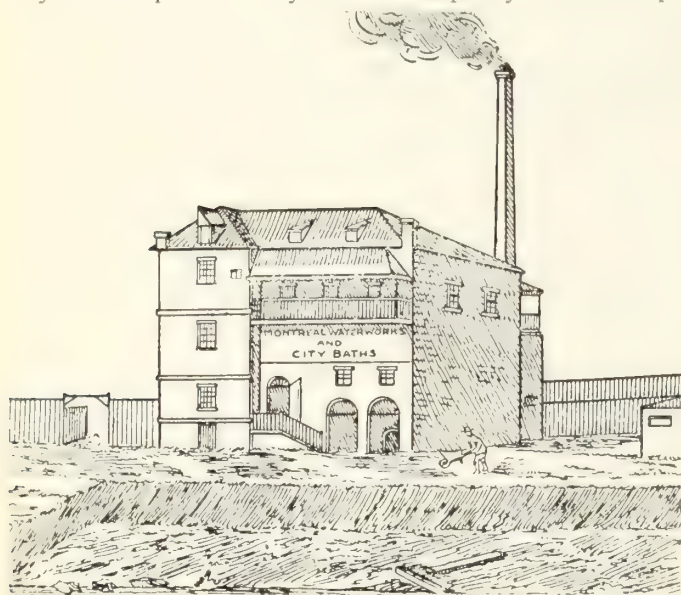
As a business proposition for the general contractor, I think it would be well to investigate this matter, as it is practically a new branch in the building business, and I am sure you can secure more cement contracts when you can say to your customers that you can overcome the unsightly color and non-uniform appearance of our greatest building material.

A recent decision of a magistrate in British Columbia was to the effect that an architect cannot claim a mechanic's lien in connection with the preparation of plans for building purposes.

History of the Montreal Waterworks with an Outline of Present Improvements

THE history of the Montreal waterworks has been compiled by Mr. F. Clifford Smith and submitted to the Mayor of Montreal and members of the Board of Commission. It is published in the form of a booklet which is prefaced by photographs of the officials under whose administration the modern improvements to the waterworks at Montreal have been conducted.

The review starts with the year 1800, when Montreal was a town of about 9,000 inhabitants who lived mainly within the old fortifications, and when the only means provided by the municipality for the sup-



Montreal Waterworks—Steam mills and baths in use in 1883.

ply of water consisted of public pumps at about half-a-dozen points. The selling of water in big puncheons was a common and quaint custom of those days.

In 1800, after considerable talk about forming a waterworks, an act was passed incorporating Joseph Frobisher (one of the founders of the Northwest Trading Company) and his associates, under the title of the Company of Proprietors of the Montreal Waterworks. The capital invested was six thousand pounds with power to increase to forty-eight thousand pounds. An exclusive franchise was given for fifty years. The system decided upon was that of gravitation. Water was obtained from a pond in the rear of the present Cote des Neiges village, and was brought to the city through wooden pipes laid around the southern slope of the mountain.

The company's trouble soon began. The supply which was from a well, was most precarious, while the frequent bursting of the wooden pipes finally resulted in the enterprise becoming a failure. In 1816 the waterworks and the unexpired franchise of thirty-five years were offered for sale and sold three years later for £5,000. The purchasers abandoned the gravitation supply from the spring and instituted a steam pumping plant, the engines, of course, being very primitive. The supply was obtained from the St. Lawrence, in the near vicinity of the city. Instead of wooden pipes, four-inch iron pipes were sub-

stituted and wooden cisterns erected. The cisterns were found to be very weak and were finally replaced with other wooden cisterns lined with lead. The capacity of the cisterns was 240,000 gallons. The four-inch pipes put down soon proved insufficient and other troubles ensuing, this company also sold out. The plant was advertised for sale and was bought in by a Mr. J. Haynes for sixty thousand dollars. Mr. Haynes quickly floated a new company which replaced the small pipes in the streets by pipes ten inches in diameter and installed a more powerful engine. In 1843 two engines were at work with a pumping capacity of 93,000 gallons. By this time fourteen miles of pipes were laid in the streets.

In 1843 also the first agitation was started for the city to own the waterworks. It was kept up till 1845, when the municipality made an offer of fifty thousand pounds for the plant which was accepted.

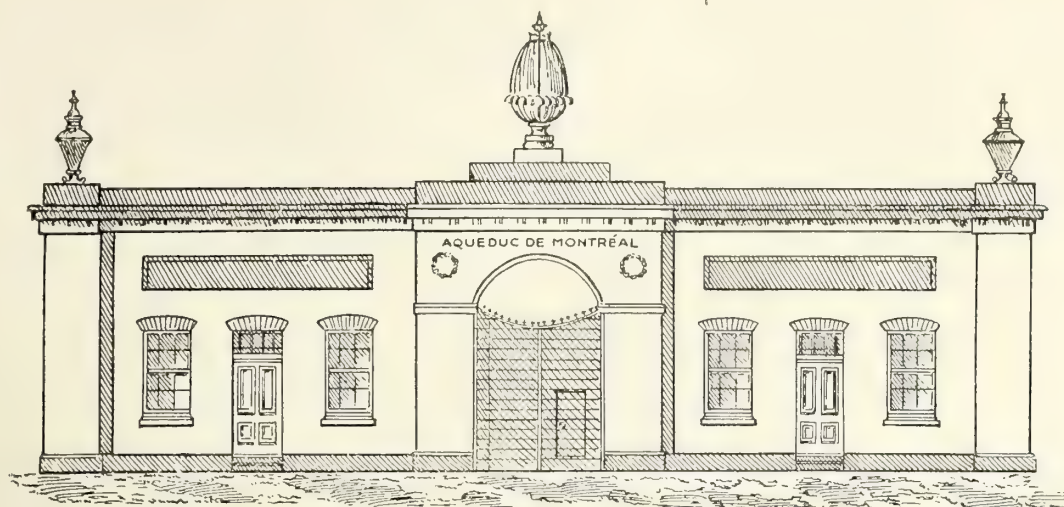
We reproduce sketches of two of the quaint buildings of early days. One peculiar looking structure shows a combination steam mill and bath as it stood in 1833. The building was four storeys high. Water was pumped from the river near the bank. The three-storey house was occupied in the year 1833 both as a storage for water and as a dwelling. The two upper storeys were altered so that they could contain two large cisterns each containing about one hundred thousand gallons of water. The lower floor was used as a dwelling house. The sketch showing the gateway with the windows and a door on each side, was what was termed the corporation's offices. Over the gates are the words Montreal Water Works. The structure in 1833 stood on Notre Dame street exactly next to the house where the cisterns were. The building has long ago disappeared.

In 1847, two years after the civic authorities of Montreal had taken over the primitive plant, the Water Committee made a report to the City Council suggesting that a premium be offered for the best plan to force water from the St. Lawrence into a reservoir on the mountain. The idea was to get water power from the Lachine Canal. The suggestion was deemed impracticable and not acted upon.

In the year 1849 the city constructed a reservoir on what now is St. Louis Square. Its height was 130



Montreal Waterworks—Storage building of 1883.



Montreal Waterworks—The private company's offices and workshops which stood on Notre Dame Street in 1833.

feet above the St. Lawrence and its cost was three thousand pounds. By the year 1850 the corporation had laid nineteen miles of iron pipe and six miles of lead pipe. The reservoir had a capacity of three million gallons.

In the year 1852, the year of the great fire, when much of the waterworks system was destroyed, the services of Mr. Thos. C. Keefer were procured by the city to draft a plan whereby the city could get an entirely new water supply. The plan he proposed was adopted and it has practically been in operation up to the present, when it is being drastically changed. The system consisted in an open canal having the entrance about a mile and a half above the Lachine Rapids. The canal or aqueduct, which was $4\frac{3}{4}$ miles long, ended at a building called the Wheel House. This building contained two vertical hydraulic wheels operating a set of six pumps having a capacity of four million gallons a day. The water was raised through a main of twenty-four inch diameter, and ended at a reservoir where the present McTavish reservoir stands. The construction of these works lasted until 1856 and cost \$280,237.

Further interesting details of the various improvements effected under civic control are given by Mr. F. Clifford Smith, but with the limited space available we must pass on rapidly.

We learn that the first steam engine was installed in 1868, by which time the consumption had passed the mark of five million gallons a day. Extensive improvements were made in the "70's" under Mr. Louis Lesage, superintendent of the water department. We are told that the work was greatly hampered by constant change in the membership of the city council, lack of funds and various other causes—no less familiar to-day than forty years ago.

Scheme of Present Improvements Outlined

Extensive improvements have been recommended by the present city engineer, Mr. Geo. Janin, after an investigation of some years.

The successful tenders for the improvements, and the dates the contracts were awarded by the city are as follows:

Lateral Conduit:—Contract awarded September 6th, 1907, to P. McGovern.

Intake:—Contract awarded September 27th, 1910, to Lemoine Fils & L. A. Desy.

Filtration Plant:—Contract No. 1, awarded July 17th, 1911, to the "British Electric Plant Co.," for the supplying and installing pumping machinery, blower and crane.

Contract No. 2, awarded July 24th, 1911, to F. H. McGuigan, for constructing final filters and appurtenances.

Contract No. 3, awarded October 9th, 1911, to F. H. McGuigan, for constructing prefilters and filtered water reservoir.

Contract No. 4, for final deepening and widening of aqueduct, awarded July 5, 1913, to the Cook Construction Company.

On October 1st, 1912, a transfer was made of the works of Mr. McGuigan to Mr. Norman McLeod.

Final Estimated Cost of Present Improvements When All Completed

Lateral conduit ..\$ 785,000 (Work done)

Intake 124,000 do do

Widening of Aqueduct:—

Contract No. 1.. 856,000 (Work done)

Surveying and

Supt's. 80,000 do do

Contract No. 2.. 2,970,000 (Estimated cost)

Engr. and super.. 80,000 do do

Pumps and power

house 425,000 do do

Filtration Plant:—

Contract No. 1.. 40,000 (Work under contract)

Contract No. 2.. 673,000 do do do

Contract No. 3.. 485,000 do do do

Contract No. 4.. 400,000 (Estimated cost)

Engr. and super.. 80,000

When to the above is added the probable cost of purchasing of land for the aqueduct, the entire completion of the system is estimated at seven million dollars.

When all of the above work is done the total value of the waterworks of Montreal is estimated at \$19,000,000. In this sum there are included, of course, all kinds of mains and pipes in the streets.

Sanitary Survey of Boundary Waters between Canada and the United States

FOLLOWING is an abstract of the report submitted recently to the International Joint Commission by the board of sanitary experts appointed to make an investigation of the pollution of the boundary waters between the United States and Canada. This is the first portion of the report, dealing with the extent and causes of pollution. Preventive measures will be discussed in a later document. The Canadians engaged in the technical side of the work are Dr. W. S. McCullough, Provincial Health Officer for Ontario, Dr. John Amyot, Professor of Hygiene in the University of Toronto, and Mr. F. A. Dallyn, Provincial Sanitary Engineer of Ontario. It may be as well to point out that the investigation began at Lake of the Woods in Ontario and terminated at Grand Falls, on the St. John river, between New Brunswick and Maine.

The number of sampling points was 1,447 and the total number of samples collected, 17,784. Many other samples were taken to show the relation between local situations and municipal water supplies, and to ascertain the character and amount of pollution due to boat traffic. Some float and temperature experiments were made in conjunction with the bacteriological investigation.

Bacterial Examination

The examination was essentially a bacteriological one. Five classes of water were arbitrarily defined, as indicated in the table.

Class 1 represents those relatively pure waters found outside the zones of pollution. Class 2 represents a slight pollution of a relatively pure water. At times such a water is undoubtedly unsafe without purification. Class 3 represents considerable pollution, requiring unremitting care in its purification. Class 4 shows serious pollution. In the Great Lakes Basin such a water should not be selected as a raw water for a purification plant; or, if the intake must be placed in such water, sources of pollution should be eliminated or nullified by sewage treatment. Class 5 represents gross pollution—from 50 to 34,000 B. coli per 100 cu. cm.

The maximum bacterial count was used as the index of intermittency of pollution, which is the great menace to water supplies. At the time of inspection extreme runoff due to floods was not encountered. Every municipality in the area investigated on the Great Lakes discharges its sewage untreated into the lakes, constituting the largest factor in their pollution. The bulk of the work was done on the connecting rivers and the ends of the lakes.

Rainy Lake, Ontario

Samples examined in Rainy Lake show unusual pollution, probably on account of the presence of construction camps and lumber mills. In general the Rainy River shows serious pollution throughout its length, but in an increased degree below Fort Frances and International Falls to the Lake of the Woods, making this whole river an unsafe source of water supply without very careful purification.

The examination of the waters of Thunder Bay showed that the pollution found there did not reach the international boundary, some 35 miles distant. The local situation is, however, an unfortunate one.

The general tendency is to spread sewage polluted water along the shores rather than out into the bay. The bulk of the water of Lake Superior is pure, about the only possible source of pollution being from the vessels plying upon it.

Lake Huron

The examination of samples in the lower end of Lake Huron showed that this water would be practically pure were it not for the pollution due to boat traffic. That portion within a radius of three miles from Point Edward Light showed a slight though definite pollution. The sample points near the shore on both Canadian and United States sides gave an average of 15 B. coli per 100 cu. cm. The slight general pollution within this portion of Lake Huron, while due in part to the large summer population and seasonal effect of streams, must be accounted for chiefly by the enormous boat traffic through the middle of this area.

The water of the River St. Clair from its head to Lake St. Clair is unsafe as a source of water supply without careful and unremitting purification. The several cross-sections from St. Clair to Algonac show gross pollution of the river, more marked on the United States than on the Canadian side, owing to the fact that the discharge of sewage is chiefly from the United States side, the Canadian municipalities below Sarnia not being sewered.

The bulk of the eastern portion of Lake St. Clair was shown to be comparatively pure.

Detroit River

The cross-section where the Detroit River leaves Lake St. Clair showed about the same degree of pollution as the lake in the centre of the channel, with increased pollution close to the United States shore. Belle Isle had considerable pollution at the head near both shores. This is enormously increased at the next cross-section, especially at the sample points near the United States shore. The stream above the intake for the Detroit city water supply was found to be an unsafe water supply without careful treatment. The application of hypochlorite of lime in the quantities or by the method in vogue in Detroit during the investigation is not considered adequate treatment. The several cross-sections from this point to the site of Michigan Central Tunnel showed a marked increase of pollution in the shore samples. The water intakes of Walkerville and Windsor, Ont., are both located in dangerous situations, owing to the discharge of sewage above these intakes and to the pollution due to navigation. Gross pollution over the Michigan Central Railroad Tunnel near the Canadian and United States shores, and a considerable pollution extending across the entire river were found.

The B. coli content per 100 cu. cm. has increased in Lake St. Clair water from below 5 to an average of 315 at the head of Fighting Island. Fighting Island divides the river into two channels. There is a great difference in the degree of pollution in these two channels. In the channel between the United States shore and Fighting Island the pollution is enormous.

An extensive investigation was made of the area at the mouth of the Detroit River and western end of Lake Erie to Put-in-Bay. The examination indicates

the existence of such gross pollution that the water in this part of the lake is unquestionably a very dangerous one, especially to crews and passengers of vessels using water pumped from the region.

There is no point from the lower end of Lake Huron to the islands which separate the western end from the remainder of Lake Erie from which a safe supply of water could be taken for even a portion of the 365 days in a year.

At Port Stanley the evidence indicates that Lake Erie is pure and such pollution as is picked up in the neighborhood of any local source of pollution is confined to that district.

Samples collected at the eastern end of Lake Erie along a line from Point Abino to the United States shore about 12 miles above Buffalo show the water in the eastern end of the lake to be pure, except as it may be influenced by the effect of navigation. Pollution from Buffalo and other sources extended but a short distance beyond the breakwaters, and the water from that point almost to the Canadian shore across the boundary is relatively pure, except as directly influenced by navigation.

Dilution of Sewage in Niagara River

The first cross-section of the Upper Niagara River showed relatively pure water on the Canadian side and the beginning of noticeable pollution from Buffalo harbor. From the next cross-section to the one below Squaw Island the pollution, though greatly increased in quantity on the United States side, was held to that shore. The pollution on the Canadian side, though of less extent, was likewise confined to its shore. This phenomenon is due to the immense volume and the great velocity of the river, and to the depth of the outlets of the Buffalo sewers. From this point the pollution tended to extend across the entire Tonawanda Channel, and from Rattlesnake Island to the point where it again joins the main river the whole channel was shown to be grossly polluted. The use of this water as a public supply, even with the stringent purification, is attended with considerable risk.

The Niagara River at Lewiston receives the water from the Great Gorge Rapids and the Niagara Falls. The mixing of the sewage affected by the falls and rapids with the river water is probably the most complete possible. The samples examined showed that from this point to the mouth of the river the water was uniformly polluted from shore to shore and that the use of water from this section of the river as a public water supply without the most careful and exacting purification should not be considered.

The situation at the mouth of the Niagara River is different from that of any other of the waters under investigation. At the mouth of the Detroit River the discharge is into an inclosed end of the lake, where it is lagooned and drifted from point to point for a considerable time before it can get into the lake itself. At Niagara, the pollution is discharged into a portion of the lake where conditions are such that the drift may take place north, east or west. Several limits of this polluted area were determined with a considerable degree of accuracy. A striking phenomenon exhibited over this area was that very little diminution in pollution occurred until the limiting boundaries of the area were reached. That is, if at the mouth of the river pollution was such as would show 1000 B. coli per 100 cu. cm., the pollution 10 miles from shore, wind conditions being favorable, would show practically the same degree of pollution. The menace in this area is almost entirely directed at the present time toward navigation between Buffalo and Toronto.

Influence of Summer Residents on the St. Lawrence River

The work on lower Lake Ontario and on the St. Lawrence River was performed at two different seasons by different laboratories. In the season before navigation commenced Lake Ontario water was practically sterile; in August there was minor pollution in the lake. The difference in the findings emphasizes the effect of boat traffic and summer residence pollution.

Below Brockville the major pollution remains near the banks of the river. Mid-stream samples showed very little pollution in the early work before navigation. The later work in August showed a very general serious pollution, due probably to summer resort population on the river and to boat traffic. The conditions from here on to Cornwall are very bad in the summer months. Unquestionably the water at Brockville and from there on should not be used as a water supply without adequate purification.

The St. John River forms the international boundary between Canada and the United States for about 70 miles of its course. The direct sewage pollution from Edmundston to Grand Falls is at present slight. There are seven potato starch factories which have some effect upon pollution.

An average for this portion of the river at this season might be tentatively expressed as follows: Average number of B. coli per 100 cu. cm., 125; average number bacteria per cubic centimeter on agar at 37 deg. C., 250.

A remarkable relation between potato starch factories and increase in B. coli was found. The character of pollution from starch factories resembles that of so-called rural pollution, the washings of manured fields, and is largely of animal origin. While it is not so dangerous as city sewage in the transmission of typhoid fever, it is nevertheless a dangerous addition in drinking water. The amount of pollution contributed is of the greatest importance because it has a direct bearing on the distance required for the stream to purify this addition to its burden of pollution and reach what may be considered its normal condition.

The total amount of pollution contributed at any of the points mentioned is relatively small, and within a short distance the number of B. coli per 100 cu. cm. drops to what may be considered the average pollution of the river. In this large stream, with the relatively small amount of pollution after mixture has been effected, marked improvement is manifest within a few miles. For instance, from the point of maximum pollution about 4 miles below Van Buren, a marked improvement is evident within 4 miles, the average number of B. coli per 100 cu. cm. dropping from 725 to 57.

Conclusions

In certain localities on the Great Lakes and in all their connecting waterways dangerous sewage pollution was shown to exist, but the great bulk of the Great Lakes water remains in its pristine purity.

The colon bacillus is practically never normally present in unpolluted waters, and the normal total bacterial count of the Great Lakes waters is below 10 per cubic centimeter on nutrient agar. This is clearly shown by the results of examination of samples collected in Thunder Bay, in Whitefish Bay, in Lake Huron, in Lake St. Clair, in Lake Erie at Abino Point section, and in cross-sections of Lake Ontario at both ends.

The boundaries of the zone of pollution along the shores or at the mouths of rivers were constantly

changing, due to the currents which are themselves dependent upon the direction and velocity of the wind. In two situations, namely, at the mouths of the Detroit and Niagara Rivers, serious pollution extends normally over 10 miles into the lake receiving the discharge. At times it may travel much farther. It was shown to travel in Lake Ontario on occasion 16 miles, and in Lake Erie, 18 miles.

The position of intake and the pollution existing in the vicinity of municipal water supplies are such that there is not a municipality using lake water which can be said to possess a safe water supply without treatment. In spite of these facts until very recently the use of untreated water was the rule. The conditions responsible for the disgraceful record of water-borne typhoid in these cities are: Unrestricted discharge of sewage by municipalities and vessels; failure to purify polluted water, and inefficiency in the purification. In certain localities the pollution is so great as to impose an unreasonable burden upon any known method of water purification, and where intakes are located in such localities some method of eliminating or reducing the pollution, whether from boats or municipalities, is absolutely necessary. It is difficult for some officials to understand, without a severe lesson, that it is not sufficient to have a water supply that is safe for 360 or 361 days in the year. There was no evidence of serious pollution of the water supply of the city of Erie from 1909 to December, 1910, yet the appalling experience of January and February, 1911, showed that pollution could take place under certain weather conditions.

Untreated water supplies are in many instances delivered to the consumer as safe. No water should be classed as safe and furnished as such which is not shown to be safe by daily bacteriologic examination. Opinions based upon a few widely scattered bacteriologic examinations of samples of municipal water supplies collected at random have really very little value even though the tests appear to indicate good water. The public is apt to base its opinion of a water supply upon such tests. This is a dangerous error. Any report upon a water supply is incomplete without a comprehensive sanitary survey. The possibility of a serious pollution even as an exceptional occurrence would be disclosed by this survey.

Information collected during this investigation shows that for lack of bacteriologic control satisfactory efficiency is not being obtained by the purification methods adopted by many of the municipalities attempting to protect themselves against the consequences of polluted water supplies.

A concrete bridge which is being built at the head of Colorado street, Pasadena, Cal., is the longest and highest bridge in the south-west. The roadway, 28 ft. wide between kerbs, is 160 ft. above the channel of the Arroyo Seco, a stream flowing beneath the finest residential section of the city, and the length of the structure is 1,468 ft. The most striking feature of the bridge apart from its long sweeping curve is the series of noble arches, the largest of which is 223 ft. from centre to centre of the piers, while there are two spans of 151 ft. and six of 113 ft. each. The arch spans consist of two continuous elastic arch ribs carrying spandril columns and in part spandril walls. These support cross beams with cantilevered ends. The massive piers rest upon the boulders and gravel of the stream bed and are tested to 11,000 lb. per square foot. Work has been in progress for more than a year, and a few weeks will see the completion of this important link in the Cali-

fornia highway system. From forty to one hundred men have been constantly employed. Cement to the extent of more than 10,000 barrels was required for the concrete, which is reinforced with corrugated bars of a strength of from 60,000 lb. to 70,000 lb.

A Plea for City Planning Organization

THE object and scope of city planning and the manner in which legislation can be secured in Canada to attain the ends desired by those interested in this important study were considered in an interesting address given before the Fifth Annual Meeting of the Commission of Conservation by Mr. G. Frank Beer, President of the Toronto Housing Company. Mr. Beer divided his subject roughly into three sections—Sanitation, Transportation and Co-ordination, the requirements which are detailed in the summary abstracted below:

Sanitation

- (a) An adequate supply of pure water.
- (b) Sanitary and economical disposal of sewage and garbage.
- (c) The prevention of slums and provision for the satisfactory housing of wage earners.

Transportation

- (a) The arrangement of transportation systems including radials, and the location of passenger stations and freight sheds.
- (b) The development of harbour facilities, including the erection of necessary wharves, bridges and docks.
- (c) The laying out of thoroughfares to accommodate the necessarily varied traffic.

Co-ordination

- (a) The laying out of desirable manufacturing districts and provision for adequate shipping facilities.
- (b) The planning of residential districts, especially for working men, so that they may be housed within reasonable distance of their work.
- (c) The location of municipal produce markets in proper relation to residential districts and shipping facilities.
- (d) The systematic selection of recreational facilities such as parks, play-grounds and swimming baths.
- (e) The location of educational institutes such as schools, colleges and public libraries.
- (f) The proper distribution of public service buildings, such as fire halls, police stations, post-offices and hospitals.
- (g) The acquiring of natural beauty spots and their development as public squares and breathing spaces.
- (h) The acquiring of land needed for the purposes enumerated under the five last paragraphs, before an enhanced value places unnecessary burdens upon the public exchequer.
- (i) Provision and planning for car-lines, sewage, gas and water-mains, telephone and electric light wires to secure the greatest possible economy in their installation, and to avoid the usual waste of repeated tearing up of pavements and consequent dislocation of traffic.
- (j) The laying out of the surrounding territory so that the natural and inevitable growth of the city may be rationally and economically guided.

The list is a long one but nothing included is superfluous. To summarize, **efficiency, economy and vision** in city planning are what are aimed at.

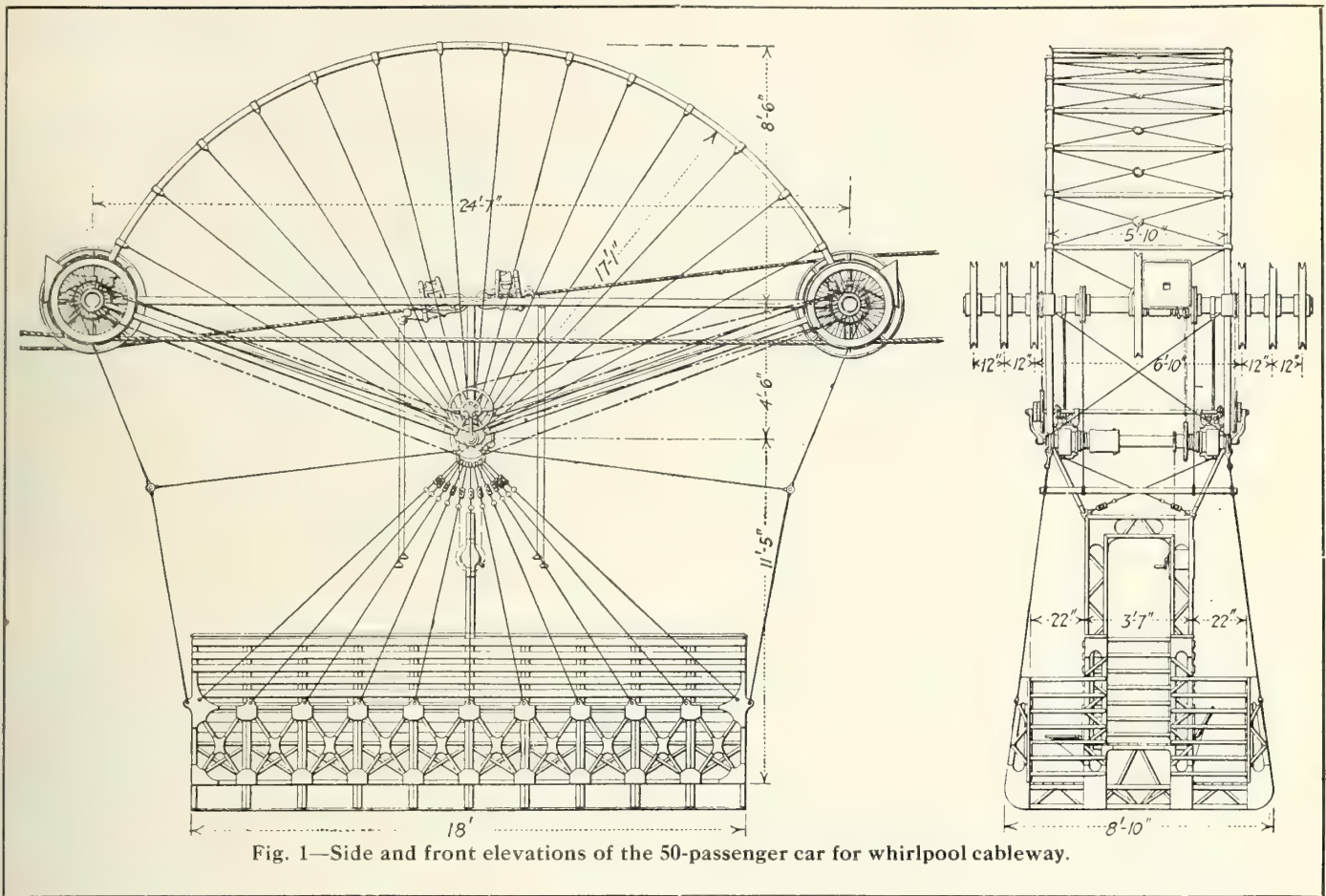


Fig. 1—Side and front elevations of the 50-passenger car for whirlpool cableway.

Proposed Aerial Passenger Cableway across the Whirlpool below Niagara Falls

CONCESSIONS were granted to a Spanish company by the Dominion Government, on November 17, 1913, for the construction of a passenger aerial cableway over the Whirlpool, situated approximately six miles below Niagara Falls, Ontario. The design and scheme of operation of the cableway will be similar to that of the system which connects the two mountain resorts on Mt. Ulia, near San Sebastian in Spain, and similar in purpose to the much bolder project which climbs the first stage (a rise of 1,370 ft. in a horizontal distance of 1,191 ft.) of the Wetterhorn ascent, in the Berner Oberland, Switzerland.

The Whirlpool system will be constructed on a somewhat larger scale than that of Mt. Ulia. The car on the latter had capacity for but 14 passengers while

the former can transport 50 passengers at a load. The termini of the line are about 1,770 ft. apart and are at the same elevation—about 250 ft. above the Whirlpool. The car has been built in Bilbao, Spain, and is there at the present time. It is believed that the actual construction work in Canada will commence in March, 1914. The cost is estimated at \$120,000.

The system in general will consist of one car drawn back and forth across the Whirlpool, travelling on six 1¼-in. cables and hauled by another. A set consisting of three cables is placed on each side of the car. Should one cable break, the car would be carried by the other five. As a further safeguard in the event of a cable parting, all the cables are outside of the car.

Each cable will be attached separately to a fixed anchorage at one station and at the other station pass

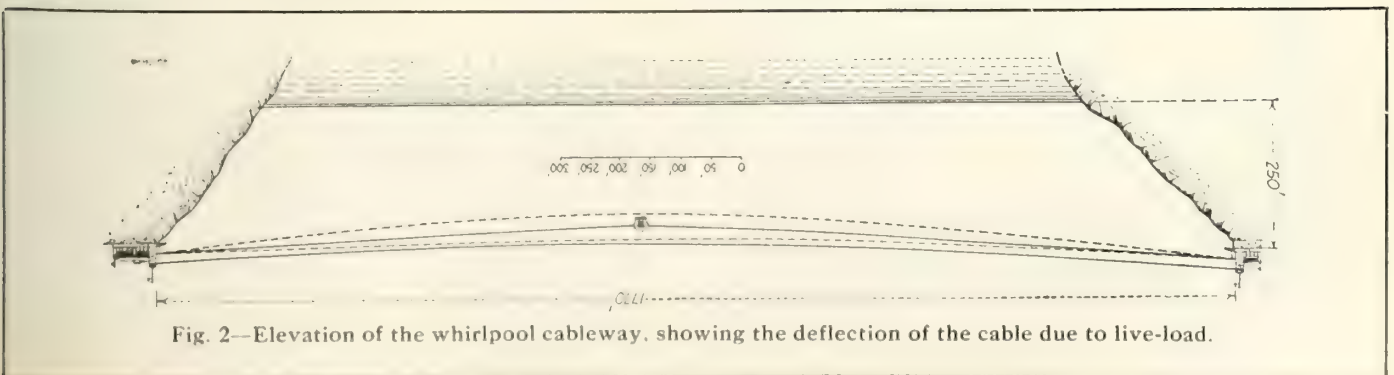


Fig. 2—Elevation of the whirlpool cableway, showing the deflection of the cable due to live-load.

around a sheave to a counter weight. As the cableway is balanced by the counterweights, the weight of the car does not increase the tension in the cables, although an increased car weight (due to passengers) will of course increase the deflection of the cables. The counterweights are designed to prevent a stress in the cables which exceeds one-third their tensile strength. An endless cable, counterweighted at one end and driven by a motor at the other station, hauls the car.

The side and front elevations of the car are shown in Fig. 1; its dimensions are 18 x 8.8 ft. in plan. The car is carried on 12 metal-spoke sheave wheels (six per axle). On each axle also, there is a tractor wheel along which runs the hauling cable. The drawing shows that the body of the car is suspended by means of a system of wires, in tension, which radiate from a curved frame whose upper and lower members are of metal tubing.

Swinging is prevented by wires which connect the car body to the two upper and one lower axles. The supporting wires from the lower axle are each provided with a turnbuckle for regulating its tension. The direction of travel is determined by means of a controller, acting through sprocket chains to single-direction jaw clutches upon either axle. Brakes are installed; and, in the event of the car being stalled, a safety car will be provided for running out on the line. Fig.



A terminus of the passenger cableway at Mt. Ulia, Spain.

2 is an elevation of the system and shows the deflection of the cables due to the car, empty and loaded respectively.

Fig. 3 is a view of the similar system of Mt. Ulia in Spain. It shows the cable connections at one of the termini. The counterweight of the hauling cable is visible; while the six carrying cables are seen, stretching at an angle of about 45 degrees from the pulleys to the concrete anchorage.

The designer of the system is Leonardo Torres y Querredo, Chief Government Engineer of bridges and roads, Bilbao, Spain. The company which propose to do the work is the Estudios y Obres de Ingenierio, of Bilbao, and its president is Victor Gorbena, Chief Engineer of the port.

Latest reports state that the engineers who will have charge of the erection work in connection with the Whirlpool cableway are about to embark from Spain for New York and that work will start on scheduled time.—Engineering News.

One of the largest subway schemes ever planned is said to be in contemplation by a British-Canadian firm of engineers and contractors who purpose organizing a company with \$25,000,000 capital to build and operate a comprehensive system of subways for Chicago.

An Interesting Industrial Undertaking in Quebec

The Grand Pabos Mills now being built for the St. Lawrence Pulp & Lumber Corporation by the Aberthaw Construction Company

ON a bay reaching back from the Gulf of St. Lawrence, near Chandler, Que., a large pulp mill is being erected for the St. Lawrence Pulp & Lumber Corporation, by the Aberthaw Construction Company, Boston, Mass. The buildings are for the most part of one-storey, located on the slope of a hill so that in some cases they go up in steps, so to speak, and give the appearance of much greater volume than they really possess. The entire plant now under construction, occupies a length of about 900 ft. east and west, with a width of some 700 ft. in the other direction. There are nearly twenty buildings in the present plans, with arrangements for a further extension of several of them as needs of the future may require.

Starting at the west end of the lay-out, a pulp storage building, measuring 78 by 162 ft., has a platform upon a railroad siding alongside the double track road. North of this is a large structure, 78 by 231 ft., of which the north-west corner is occupied by the offices, while the balance is supplies and repair shop. This building continues as the bleacher room, 200 ft. long by 78 ft. wide, and containing nine large concrete bleacher tubs. South of the bleacher room, and adjacent to the pulp storage building is the machine room, 49 by 269 ft. East of the bleacher room and machine room is the screen room divided into two parts, the room as a whole being 150 by 156 ft., with coarse screens in the southerly section and fine screens to the north. Directly north of the screen room are the four blow pits, the space occupied being 67½ by 81 ft. Each blow pit measures 18 ft. 6 in. by 52 ft. and has a depth of 16 ft. 8 in. at one end and 15 ft. 2 in. at the other.

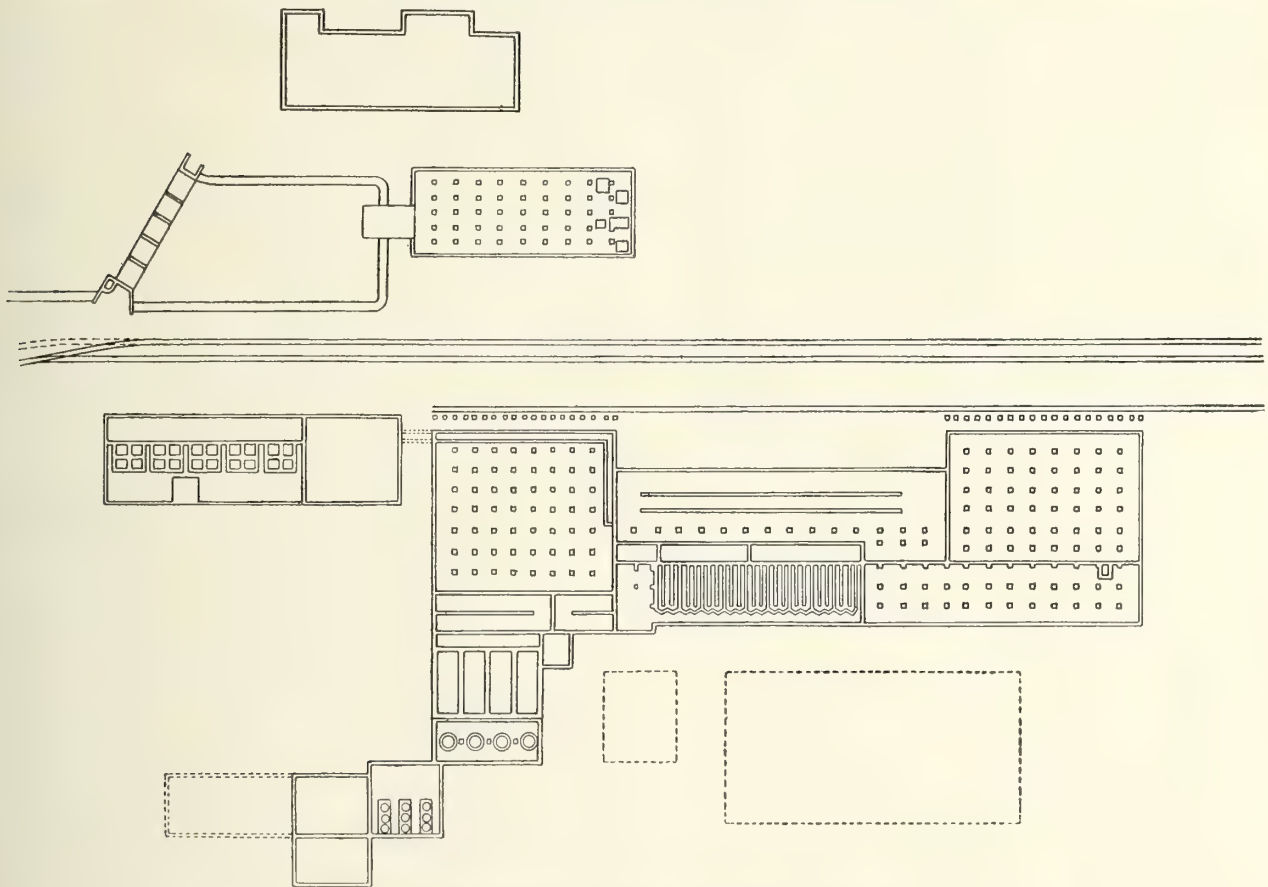
North of the blow pits is the digester house, 35 by 81 ft., containing four digesters 16 ft. in diameter by 54 ft. 6 in. high. These are fed from a conveyor in the monitor on top of the building. The height of this building is 115 ft. Practically all of the others are single storey only. North of the digester house is the acid plant, 57 by 58½ ft., adjoining which are the Pyrites burners in a building 50 by 165 ft., and the sulphur storage building 40 by 64 ft. All of the buildings so far mentioned are continuous without any breaks.

North of the supply and repair building and the bleacher room, is to be an electrolytic plant at some time in the future, which will measure about 80 by 250 ft. Between the electrolytic plant and blow pits and digester house is the filter house, 60 by 73 ft., with provision for expansion northward as may be necessary. In the extreme north-west corner of the property is a 30,000 gal'on tank, mainly for fire protection purposes, and with its bottom at an elevation of 180 ft. above the bay. (Most of the mill is at an elevation of about 50 ft.)

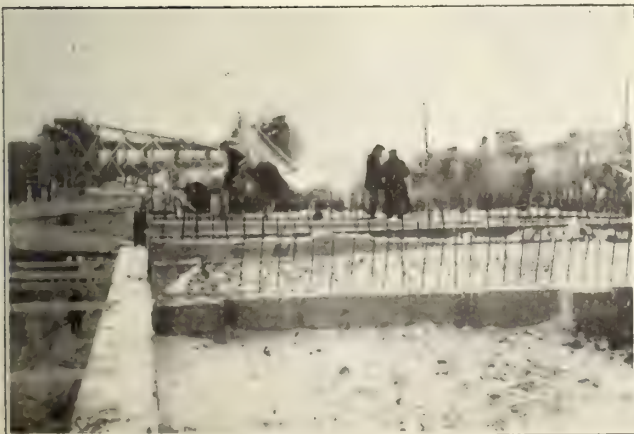
East of the main group of buildings is the power plant, consisting of a turbine room 72 by 78 ft., and a boiler room 72 by 164½ ft. There is provision for future extension of the boiler room to about double its present capacity. The present room will contain eight 475 B.h.p. boilers with space for two more later. This room is quite near an arm of the Bay and condensing water is drawn in through a pipe running under the



Panorma of St. Lawrence Pulp and Lumber Corporation's new plant. Foundations for wood room in left foreground. Excavation for hot pond in the lower right.



General layout of buildings at Grand Pabos, Que.



Bleacher room foundations, looking between pulp storage and supply shop buildings.



Under the floor of the repair and supply shops at the Grand Pabos plant.



St. Lawrence Pulp & Lumber Corporation's new plant at Grand Pabos, Que.
Pulp storage building in foreground. Office, and repair
and supply shops in rear.

railroad tracks and out to a crib a short distance from shore. After being used, this water, which has been heated by the condensing steam, is discharged into the hot pond, measuring about 90 by 160 ft., and located just south of the railroad tracks adjacent to the turbine and boiler rooms.

This pond is separated from the Bay by a bulkhead so that during the winter time logs in it can be handled without fear of their being frozen up, the temperature being kept up by the hot water from the condensers. There are three separate log hauls or conveyors, from the hot pond, going respectively to the wood room and the sawmill, while one, directly from the Bay, goes to the sawmill. The wood room measures 72 by 182 ft. and is located just west of the hot pond. South of the hot pond and wood mill is the sawmill, 64 by 193 ft., with two or three similar wings, and adjacent to this, another boiler house, 46 by 62½ ft.

The whole plant is laid out for the most economical handling of materials, from the logs in the water or on board schooners, to the finished pulp. The Government of Canada is arranging for dredging the harbor so that vessels of 6,000 tons may safely enter at all stages of the tide. In this way, both the receipt of raw materials and their shipment by water is facilitated, while the railroad connections provide for similar handling by rail. The company controls some 500 square miles of territory from which pulp wood will be cut, so that apparently there is nothing to hinder the full development of this plant as business conditions render it necessary.

Mr. H. S. Ferguson, of New York, is the engineer.

Pneumatic methods for finding flaws in rock indicate whether or not the rock is pervious, but they do not locate the seams. An elaboration of this method is to attach rubber washers to a mouthpiece and by means of them close off a small part of the hole and thus locate possible seams. This procedure, however, is tedious and a method used near Augusta, Ga., for the investigation of the foundation for the dam of a hydro-electric project is claimed to be more economical. Here test holes were drilled into the granite—which was the prevailing rock formation—and dye forced into the holes. In subsequent core-borings the color showed where flaws existed. The method proved satisfac-

tory in that the character of the ledge was known in advance, and thus obviated unnecessary drilling and excavation.

On Flats

THOSE of our readers who dwell in "flats" or apartment houses in the larger cities of the country cannot fail to appreciate the following abstract of an essay on flats by George Fitch and copyrighted by George M. Adams:

"Flats are an invention whereby people who live in crowded cities can be piled up in layers like pancakes.

"A flat consists of a collection of living rooms all on one floor. A flat building consists of from six to sixty sets of rooms all under one roof and under the overlordship of a janitor who lives in the basement and doses the furnace with coal on the homeopathic plan. A really expert janitor can run a twelve-flat furnace all winter on a wagon load of coal and can so chill the tenants when they come down to complain that their rooms will seem tropical when they return to them.

"Flats are built of brick, wood, stone, strawboard, felt and tissue paper, the latter being used principally for partitions. An economically built flat building is usually provided with a lightwell which is entirely filled with conversation. By means of this well the occupant of the top flat can hear what the husband of the first floor says when the coffee doesn't suit him, and when the woman in number 2 tells her late returning spouse that he is a brute the women in numbers 1, 3, 4, 5, 6, 7, and 8 quiver with simultaneous indignation.

"Flats have handsome hallways fitted with New Jersey Turkish rugs, and back porches where one may have a garden consisting of a geranium. They are also provided with bathtubs and two kinds of water, cold and not so cold. In the cities, owing to the high price of ground, aldermen and building material, the rooms in a flat are sometimes very small—so small that when the daughter is playing the piano the mother has to wash the dishes gently for fear of splashing on the music—so small that the members of the family have to be measured for the bedrooms as they would for vests, and anyone weighing over 180 pounds has to work himself into the bathroom by means of glove powder and a shoehorn."

Montreal Builders' Exchange Reports Highly Successful Year

FROM one point of view 1913 was the most successful year in the history of the Montreal Builders' Exchange. It had the largest revenue, \$13,598, on record, while the membership fees collected, \$3,868, were also the highest recorded. The annual meeting, held on January 26, was presided over by Mr. J. Brunet, who in his address, reviewed the financial position and also the events of the year. He referred to the fact that the permanent exhibition of builders' supplies established in the Eastern Townships Bank Building had not proved successful from a financial point of view. The revenue from the exhibit hall and offices in 1913 was \$1,784.77 less than in 1912 and if the Exchange were fortunate enough to collect the \$432.99 still in arrears, they would yet be \$1,351.78 behind in this account. The report showed that the decline in interest and support in this department had been steady since 1910. As it was necessary to leave their present premises by May 1st, the outgoing board had been able to secure for the next three years a floor in the Victoria Building, on Victoria Square. The exhibit feature would be done away with; but, at the request of the present sub-tenants and others who desired to have desk room with the Exchange, they would provide for an amount of space to be devoted to that purpose. The policy of the Exchange in the past, like some others, had been to nurse the cause it stood for and the people it existed to help. The results had been unsatisfactory, both to the Board and to the Secretary. The time had arrived when a new policy should be adopted. At the last meeting, after reviewing the situation carefully from all sides, the Board decided to have the regulations of the Exchange carried out rigidly; and where the by-laws were not in accordance with their views they must be amended to meet the conditions. Only men in good financial standing, able and willing to pay their way both in business and in relation to the Exchange, could be members and receive the full benefits of the organization. Those in arrears for membership dues at present must be notified, and if arrears were not paid up within a limited time the names must be "posted" in the Exchange in accordance with the by-laws. Those more than one year in arrears were to be suspended. The members of the present board had expressed the determination to raise the standard and status of membership in the organization to the highest point, so that, as originally intended, it should mean something to hold a membership card in the Exchange. The hearty approval and co-operation of the entire membership was counted upon in this matter both morally and financially.

The report of Mr. R. L. Werry, the secretary-treasurer, stated that there was a deficit of \$1,000, but as \$2,000 were in arrears and \$4,000 were due as fees, there were plenty of assets to offset this deficit. The revenue for the year was \$1,000 higher than in any previous period and was \$1,600 ahead of 1912.

It was decided to wipe out the deficit of \$1,000 by a subscription among the members; also to forego the annual banquet. The members acquiesced in the abandonment of the exhibition, and approved the idea of removing the offices.

The following are the officers for the present year: President, Mr. Thomas Gilday, of Campbell, Gilday Company, Limited; first vice-president, Mr. Frank Pauze, of U. Pauze & Fils Company; second vice-president, Mr. Ernest W. Sayer, of the Sayer Electric; directors, Messrs. John Allan, Ernest Richardson, Kennedy Stinson, T. A. Morrison, John Quinlan, P. S. McKergow, Rene Lessard, J. Penrose Anglin, W. Cle-

ment Munn. Trade representatives, Messrs. Joseph Thi-beault, Master Plumbers' Association; W. E. Potter, Master Painters' and Decorators' Association, Wm. Nonnenman, Mantel and Tile Dealers' Association; committee, N. T. Gagnon (convenor), W. E. Ramsay, J. E. Walsh, K. D. Church, R. L. Werry, secretary.

Engineers' Club of Toronto—Annual Meeting

At a representative and enthusiastic meeting of the Engineers' Club of Toronto, held at headquarters, 90-96 King Street West, on the evening of Thursday, February 5, gratifying reports were submitted by the Secretary-Treasurer, Mr. Wolsey, on behalf of the Directors. The Club is in excellent condition financially, there having been great improvement over the records of previous years. Enterprising measures are being considered with a view to extending the scope and facilities of the Club and important plans are under consideration. During the evening, Messrs. W. A. Bucke, D. A. Dunlap, Arthur Hewitt, Chas. H. Heys and T. S. Young were elected to the directorate, Messrs. Bucke, Heys and Young being re-elected after having served for three years. The work of the President, Mr. Burke, during the past year was eulogized in the highest terms, while generous tributes were also paid to the efforts of the Secretary-Treasurer, Mr. Wolsey, and the Directors. Mr. Willis Chipman congratulated the Club on having the most representative engineering membership of any similar organization in a city the size of Toronto on the American continent, the percentage of technical members being over eighty. Mr. Heys attributed the Club's improved financial status largely to the luncheon and dining facilities, the receipts from which had nearly doubled in the short space of a twelve-month.

The meeting unanimously approved of a proposition submitted by the Directors for a new club building.

Canadian Railroad Development

Application is being made for an act to incorporate the Northwestern Railway, a route which proposes to link up the Western province with the head of the lakes.

The Canadian Northern Railway will soon begin a train service on its new road into Calgary, which is an extension from Saskatoon across the most productive portions of Saskatchewan and Alberta.

The Grand Trunk Railway has the distinction of being the first whose design for its own exhibit building at the San Francisco Exhibition has been accepted by the exhibition authorities, who will now make this the model for each of the other companies' exhibit.

The Toronto Board of Control has decided to oppose the application to the Legislature of the Toronto and Niagara Western Railway Company for an extension of time to complete their railway. Under the Act of 1909 the company were given five years in which to construct it, which period expires on April 7 next.

The large dam across the Souris River, to the south-east of Weyburn, Sask., on which the C. P. R. has been for some time engaged, is now finished, and pumps and piping installed to connect the water supply with the railway yards. The Canadian Pacific is thus assured of one of the best water supplies on its entire system.

A report on the extension of the T. & N. O. Railway to

St. James' Bay has just been issued. There are two routes, one being described as the east and the other the west routes, and these have been investigated. It is said that the attention of the Ontario Government has been directed to Moose Factory at James Bay as the terminus of the line.

The project for a government-owned railroad in Alaska is at present before the United States Senate. The measure which is practically the same as the Chamberlain bill, would authorize the president to construct about one thousand miles of railway at a cost not to exceed \$35,000,000, to connect some point on the Pacific Coast of Alaska with the interior of the territory.

The Grand Trunk Pacific Railway station will probably be the largest building to be erected in Regina during 1914. This station, together with laundry, power house and train sheds, with connecting tunnel from the station to the hotel, will cost in the neighborhood of \$1,000,000. The greater proportion of the work of erecting the Grand Trunk Pacific Railway hotel yet remains to be done. Only the foundation has been completed.

Sir John Lambert Payne, controller of railway statistics, in his annual report states that during the year ending June 30 last, the mileage on Canadian Railways increased by 2,576, bringing the total up to 29,304 miles. Ontario leads with 9,000 miles, Saskatchewan being second with 4,651. At the end of the year 18,647 miles were under construction. The cost of government-owned and operated railways, representing 2,131 miles, reached a total of \$126,930,887 in 1913.

St. John, N.B., Enterprise

A number of important projects have been receiving attention at St. John, N.B. The municipal council has decided to ask the Legislature for authority to issue bonds to the amount of \$300,000 for a new general hospital. It has also been decided to erect this year at a cost of \$50,000 a hospital for advanced cases of tuberculosis.

The municipal council and the St. John Railway Company have agreed upon terms for the extension of the street car line through east St. John to Little River, to the new industrial suburb of Coldbrook. The provincial government will be asked to ratify the agreement, so that work may be begun as early as possible in the spring and pushed forward to completion, if possible, by mid-summer.

The Fenton Land & Building Company, which in the last few years has erected forty houses in St. John, N.B., and its outskirts, has plans completed for twenty new houses to be erected next summer.

Work has been continued throughout the winter on the new St. John sugar refinery, on which more than three-quarters of a million dollars has already been expended. Two hundred men are now employed, and a great deal of construction work yet remains to be done. The steel frame of the new post office is up three storeys and shows that the structure will be an imposing one, making ample provision for the postal requirements of the city for many years to come. The contract of Connolly & Charleson, who were erecting three new wharves at west St. John, has been cancelled by the Dominion Government, and awarded to the Maritime Dredging Company, with provisions for prosecuting the work rapidly so that at least two of these berths may be ready for use by the steamship lines next winter. The construction of grain conveyors from the C. P. R. elevators to two additional wharves on the west side is now practically completed. Early in the summer work will be begun on the steel superstructure of the new street car and traffic bridge which will connect east and west St. John. The building of harbour works at St. John will be conducted on a more extensive scale this year.

Personal Mention

Mr. W. J. Moore, C.E., has been appointed Town Engineer of Pembroke, Ont.

Mr. Robert Thompson, a well-known Belleville contractor, of the firm of Thompson and Donahue, died on January 28 after a short illness.

Mr. A. B. Garrow, Assistant Engineer Main Drainage Department, city of Toronto, is at present spending a few weeks' holiday in Bermuda.

Mr. Ernest E. Brydone-Jack, professor of Civil Engineering at the University of Manitoba, has been elected a member of the Institution of Civil Engineers.

Mr. J. W. B. Blackman, City Engineer of New Westminster, B.C., has been elected to membership in the American Society of Civil Engineers.

Mr. Ernst A. Richardson, City Commissioner of Saskatoon, has resigned in order to resume his connection with the G. H. Archibald Construction Company of that city.

Mr. J. T. Whitlawn, formerly chief inspector in the City Architect's Department, Toronto, died on January 30 after a long illness in the Western Sanitarium.

Mr. W. H. Woodbury, Assistant Engineer, Alberta Central Railway, Kamloops, B.C., has been elected a member of the American Society of Civil Engineers.

Mr. Andrew Broder, M.P. for Dundas, is to succeed Dr. Mills on the Dominion Railway Commission. Dr. Mills, who has completed ten years of office, will be superannuated.

Mr. C. McN. Steevens, Resident Engineer, Department of Public Works, St. John, N.B., has been elected an associate member of the American Society of Civil Engineers.

Mr. John Bell, president of the Wallace Bell Company, Limited, Montreal, artesian well drillers, died in Moose Jaw on February 1, after a brief illness. He was 43 years of age.

Mr. George Latham, a well-known Ottawa contractor on concrete construction work, is a candidate for the office of Public School trustee in Dalhousie ward of the capital.

Mr. L. W. Rundlett, city commissioner of Moose Jaw, Sask., resigned on February 1. He is now taking a vacation at St. Paul, Minn., where he may be addressed at 607 Lincoln Avenue.

Mr. John Robertson-Bird, one of the best known artists in stained glass in the Dominion, died on January 27 at Montreal. Mr. Bird, who has reached the age of 65 years, had designed the windows in many churches throughout Canada.

Mr. T. H. Drury, until recently general manager and chief engineer of the Longitudinal Railway of Chili, has returned to Canada and joined Mr. E. J. Walsh, of Ottawa, in the firm of Walsh and Drury, consulting engineers, with headquarters at Ottawa.

Mr. J. T. Breckon, formerly engaged on waterworks and sewer construction on Vancouver Island, has been appointed Assistant Engineer of the Waterworks Department at Vancouver. Mr. Breckon has had extended experience in various branches of engineering in the United States.

Messrs. Thompson, Daniel & Colthurst, architects, Saskatoon, have dissolved partnership. The practice will be continued by Messrs. T. Brammall Daniel and C. Buller-Colthurst, under the firm name of Daniel & Colthurst. The offices of the new firm are in Central Chambers, Saskatoon.

Mr. James D. Sword, a well-known consulting mining engineer and a resident of British Columbia for over twenty years, was accidentally drowned while on a trip to record assessment work on a mining claim recently. The late Mr. Sword was associated with the founding of the Canadian Mining Institute.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

A new cement brick factory has been erected at St. Mary's and the plant will be in operation shortly.

For the month of January the Montreal building permits totalled \$409,645, as compared with \$485,600 in the corresponding month last year.

The last contract for the upper end of the Trent Valley Canal will be let this month and the work below Peterborough is expected to be completed by August, provision having been made in the estimates for finishing the undertaking.

Work will proceed this year on the new Government dry dock at Tuft's Cave, on the Dartmouth side of Halifax harbour. This will be one of the largest dry docks in Canada. The preparation of plans will be begun in the near future.

The Toronto city council has given notice to apply to the Legislature of Ontario for an Act to empower the city council to validate certain debenture by-laws passed by them and also by the Town of North Toronto for construction work amounting to over \$8,000,000.

The Berlin, Ont., city council has passed a by-law prohibiting the issuing of permits for the erection of residences or remodelling of buildings for residential purposes on lanes and streets less than 40 feet in width. This measure is taken to prevent slum conditions in the city.

The Toronto Commissioner of Works has recommended that a private heating system be installed on Bain Avenue in connection with the Toronto Housing Company's development scheme. Mr. Harris stipulates an area rental to be paid in respect to the street conduit.

Plans for the proposed new sewer scheme for North Toronto are understood to have been completed by the city's engineers and a detailed report will be submitted shortly to the city council. The combined system is recommended. The estimated cost will be between three and four million dollars.

The Council of Westmount, P.Q., have decided on the purchase of a block of land between Sherbrooke street, Argyle avenue, and Cote St. Antoine road, on which to build a new city hall, light office, and fire and police station, the total cost being \$300,000. This will enable the council to concentrate the various departments.

As the result of the judgment of the Governor-General-in-Council dismissing the city of Toronto's appeal against the order of the Dominion Railway Board, the city will be required to pay at least \$500,000 made necessary by the increase of the headway in the Yonge Street subway at the northern grade separation, and the widening of the street from 66 ft. to 86 ft.

To provide additional accommodation a large annex has just been completed at the Windmill Point elevator, Montreal. The annex has a capacity of 1,070,000 bushels, making a net capacity of 2,150,000 bushels. There are in this new building 28 concrete tanks, 25 feet in diameter and 100 feet in height, arranged at right angles in four rows, with seven tanks in each row. The tanks are constructed of reinforced concrete, having their adjacent sides rigidly united. This is

the second largest grain bin on the Grand Trunk system, the largest being located at Fort William, with a capacity of 5,700,000 bushels.

The decline in building activity in Toronto for some months past was again reflected in the figures for January which show that the value of permits issued last month was only \$895,395, as against \$1,276,084 in the corresponding month last year. The permits issued in January two years ago amounted to only \$774,165, but with that exception the month just closed was the most inactive in several years.

The main estimates tabled in the Dominion Parliament a few days ago totalled \$146,786,126 for ordinary expenditure, this being an increase of over three and a half millions. Among the largest votes are the sums for the Hudson Bay Railway, the National Transcontinental, the Halifax Terminals, the Welland Canal and the development of the national ports. The vote for the Hudson Bay Railway is four and a half millions, for the new Welland Canal four millions, for the Quebec Bridge three millions, and for the Intercolonial Railway seven and a half millions. A million dollars has been voted for the Toronto Harbour improvement.

The project for the joint construction by the governments of Canada and the United States of a deep-waterway for the ocean-going vessels from Montreal to Duluth, Minn., has been launched through the International Joint Commission which has the jurisdiction for the boundary waters of the two countries. The scheme for the ocean waterway for navigation from the head of Lake Superior to the Atlantic has been talked of for several years. Several routes have been proposed for the project the cost of which is estimated at from \$100,000,000 to \$300,000,000, but the one said to be the most favorable to the United States provides for the utilization of all the lakes on the St. Lawrence River.

WESTERN CANADA

Mr. W. J. Trequillus is shortly to open his new plant for the manufacture of clay products at Calgary, and it is expected that about 200 hands will be employed.

The city of Winnipeg purposes expending \$1,000,000 for improvements to the light and power system. Half of this amount will be spent in constructing a new flexible tower transmission line 77 miles long.

The new drill hall for Victoria, B.C., will be commenced immediately, the contract having been awarded to Parfitt Bros. The cost will be in the neighborhood of \$250,000, and it is expected the work will be completed within the year.

Following the application of the Hudson Bay Company for a permit for their new Department store at Victoria, B.C. The city council has passed an amendment making the limit 120 feet for both steel frame and reinforced concrete buildings.

The Hotel Piedmont at Calgary, when finished, will be one of the best hotels on the continent. It will be opened within the next few months. Externally the building is French renaissance. Buff pressed brick is used for the facing of the walls, Indiana limestone being used for the trimmings. The building comprises ten floors with a roof garden and sun

parlor on the roof. The structure is built of steel and reinforced concrete throughout. The architects are Messrs. E. & W. S. Maxwell, and the contractors, F. Lyall & Sons Construction Company.

The annual meeting of the Saskatchewan Association of Builders' Exchanges will take place in Moose Jaw on February 16. The principal question for discussion will be the act regarding the payment of wages to employees which was passed at the last session of the Legislature.

The Greater Winnipeg Water District scheme, based on the report recommending the Shoal Lake supply, is making satisfactory progress and tenders for the following preliminary work have been received:—railway track grading and laying, including clearing right-of-way; 60-lb. rails and sundries; an 85-mile telephone line; rock core drilling near the proposed Red River crossing of the aqueduct; and five residences and office buildings. The country between Winnipeg and Indian Bay has been explored and cross-sectioned, and trial lines are being run for the aqueduct. Considerable success is being met in the effort to locate a continuous gravity flow line from Shoal Lake, the proposed source of supply, to Winnipeg. The engineers in charge of the five surveying parties are Messrs. George F. Richan, Archie Paget, Douglas L. McLean, A. C. D. Blanchard and Charles J. Bruce. The chief of design in the Winnipeg office is Mr. Max V. Sauer, and Mr. W. G. Chase, of Kerry and Chace, Toronto, is chief engineer, the consulting engineer being Mr. J. H. Fuertes, of New York.

On February 1st the Des Moines Bridge and Iron Company, of Pittsburgh, Pa., and Des Moines, Ia., adopted the name Pittsburgh-Des Moines Steel Company. There has been no change in the management of the company. The change of name has come as a natural result of the growing business of the firm which has made necessary a name that more properly describes its national scope. The company has built a large share of the elevated steel water tanks which have been constructed throughout the United States and Canada during the last fifteen years. Because of the wide territory covered, the old name was found to be a serious inconvenience, since it frequently created an erroneous impression that the home of the company was in the west. Seven years ago a plant was built in Pittsburgh, Pa., to obtain the full advantages of prompt deliveries of materials and minimum freight charges. Since that time this eastern plant has been enlarged and thoroughly equipped with all modern machinery until it has a greater capacity for steel water towers than any other plant in the country. The general offices of the company were also moved to Pittsburgh and the firm is now situated most advantageously for handling business in any part of the United States of Canada. Contracting offices have been maintained in Pittsburgh, Des Moines, Ia., Dallas, Texas, Charlotte, N.C., and San Francisco, California, for some time. And on January 1st, 1914, a new office was opened at 50 Church Street, New York City. Mr. J. E. O'Leary, who has represented the Des Moines Company in the eastern coast territory for a number of years, is in charge of the New York City office. All business in the coast states north of Virginia and in eastern Canada will be handled through the New York office.

Many railway engineers were present at the annual dinner of the Canadian Railway Club, held at the Windsor Hotel, Montreal. Mr. R. W. Burnett, master car builder of the C. P. R., presided and among the speakers were Mr. F. P. Gutelius, general manager of the Canadian Government railways; Mr. W. McNab, principal assistant engineer of the G. T. R.; Mr. M. J. Butler, president of the Canadian Society of Civil Engineers; and Mr. W. Butler.

Foundation Company's Reunion

THE presence in Montreal of many of the chief officials of the Foundation Company, Limited, was taken advantage of to organize an informal dinner at the Engineers' Club. The company, as many of our readers are aware, have carried out, and still have in hand, jobs from the Atlantic to the Pacific, and it is very rarely that so many officials meet at a common centre. Mr. John W. Doty, vice-president and general manager, presided, and among those present were Mr. Franklin Remington, president of the company; Mr. Henry Holgate, consulting engineer, of Montreal; Mr. Lawrence Macfarlane, legal adviser; Mr. James Freeburn, an American visitor; Mr. Alexander Allaire, manager of the western branch; Mr. C. A. D. Bayley, eastern manager; Mr. R. E. Chadwick, chief engineer. The company numbered about thirty. During the evening the staff made presentations to Mr. Remington and Mr. Doty.

The following was the humorous bill of fare:

THE FOUNDATION COMPANY, LIMITED MONTREAL - - - VANCOUVER

Bill of Material

Cylinder Oil.

Hand Tools and Supplies.

Air Oil.

Mud Lake Suckers.

Generator.

Transformer.

Warning—This line carries 10,000 volts.

Cast Iron Weight avec Irish Packing.

Frozen Dynamite.

Reinforced Rubber Gaskets.

Yellow Strand, lubricated.

Frozen Concrete.

Rip Rap.

Bolts, Nuts, and Orange Peels.

Sand Hog Brand.

Spun Oakum.

10d. Nails.

Job:—Passing Show of 1913

Owner	Franklin Remington
Consulting Engineer	Henry Holgate
Legal Adviser	Lawrence Macfarlane
Underwriter	James Freeburn

Organization

Superintendent	John W. Doty
Night Superintendent	C. A. D. Bayley
Engineer	Albert Pomplin
Rodman	R. E. Chadwick
Office Man	Alec. Allaire
Timekeeper	Frany Quilter
Material Man	Frank Ross
Office Boy	L. F. Gibson
General Foreman	C. A. Wentworth
Pressure Foreman	W. I. Johnson
Master Mechanic	H. B. Kelsey
Labor Foreman	H. E. Wood
Rigger Foreman	F. S. Crowell
Sand Hog Boy	Ralph Dalton
Sand Hogs	{ Alec. Alexander A. A. Pitts
Pipe Gang	{ F. W. Schwartz R. Molstad
Shorers	{ C. McDonough A. S. Goodstone
Blacksmith and Helper	{ Carl Schelder Fraser-Campbell

An interesting new catalogue is devoted to the Shearer & Mayer Dragline Cableway Excavator. The description and numerous photographs contained in this catalogue convey an excellent idea of this class of excavating machinery and the many uses to which the excavator can be installed for the economical handling of material. The excavator is used for material which cannot be economically handled with ordinary boom line or steam shovel excavators. With this cableway excavator it is possible to dig over areas exceeding 200 to 800 ft. and to convey the material direct to spoil piles or elevate it into bins or hoppers in one operation with a double drum hoist. The machine was designed primarily for digging material over long spans from under water.

The Wheeler Condenser & Engineering Company, of Cateret, N.J., have opened an office at 122 Board of Trade Building, Montreal, under the management of Mr. Jos. McKay, Jr., who has been New York manager of the Wheeler Company for a number of years. The company make a specialty of surface and jet steam condensers, forced and natural draft water cooling towers, feed water heaters, evaporating apparatus, and special castings for chemical industries.

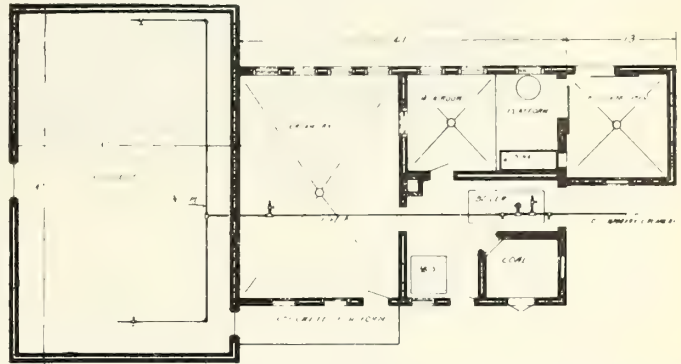
The American Road Machinery Company of Canada, Limited, Goderich, Ont., manufacturers of crushing, road-building and contractors' machinery, will start the erection of an up-to-date new plant in the spring. The building will be 400 ft. long and 110 ft. wide, 30 ft. to the square, with 70 ft. runway for electric cranes. The latest principles of design will be embodied. The building is to be of steel skeleton construction, concrete curtain walls and modern fireproofed roof. Electric power will be used throughout and a vacuum heating system will be installed in all probability. The property consists of seven acres, located on the line of the Grand Trunk Railway, so that the transportation facilities will be unexcelled. An up-to-date line of machinery is to be installed in the plant. The American Road Machine Company are the largest exclusive manufacturers of road equipment in Canada and the high grade of their products is adding to their reputation. The officers of the company are: Mr. S. Jones Philips, president; Mr. C. L. Moore, vice-president and treasurer, and Mr. J. W. Kitts, secretary.

Concreting in Cold Weather

ILLUSTRATED herewith is an ice-house and creamery at Boltonville, Vt., erected last November according to the Van Guilder Hollow Wall system of construction. The owners, H. P. Hood & Sons Company, Boston, have a number of stations scattered over several states and the above construction was selected as being particularly desirable on account of the lightness of the Van Guilder machines, their ease of transportation and simplicity of operation. The new building was to replace a small plant destroyed by fire.

The construction in this case was 4 in. walls separated by an air space of $2\frac{1}{2}$ in. for insulation purposes. This double construction is particularly desirable wherever a high degree of insulation from heat and cold is desired, and it also effectually prevents dampness.

The rebuilding was delayed for various reasons until



Plan of creamery, showing temporary piping for steaming walls

after the first of November, and as the plant was located almost at the base of the White Mountains, the builders were considerably perplexed as to how to keep the walls from freezing and as to whether they would set fast enough to allow continuous work with the wall machines.

As the buildings consisted of an ice-house, 36 x 45 ft., with 19-ft. walls, a creamery, 41 x 30, and a receiving shed, 13 x 15, with 12-ft. walls, there was a large exposed area to be protected, but Mr. C. D. Gilbert, representative of the Van



Icehouse and creamery, Boltonville, Vt. Walls protected and cured by steam turned into air chambers, a method which greatly extends the season for hollow wall construction work.



Storehouse for the Nova Scotia Steel and Company, Sydney Mines, N.S.

Gulder Company, was equal to the emergency. There was a boiler on the premises that had been in the burned creamery and this suggested to Mr. Gilbert that steam might be turned into the continuous air space and the walls steam-cured. Plenty of old pipe was at hand and lines were run so as to reach every part of the building by means of steam hose connected to the walls. As fast as they were built the walls were covered with strips of tar paper, weighted with boards, and steam was turned on, with the result that the concrete set in about three hours so as to allow another course to be laid and was past danger of freezing in six hours. The entire walls were erected in three weeks. The thermometer went as low as twenty degrees and at one time there were four inches of snow, yet the work was carried on successfully.

This is claimed to be the solution of the problem of how to protect and cure double concrete walls in cold weather, and doubtless it will result in extending the season for this type of construction work. In fact this steam-curing process should place concrete in its proper place among building materials where double walls are specified, as it can be used in any weather suitable for other construction work.

We also reproduce a photograph of the store house built according to the Van Gulder system for the Nova Scotia Steel & Coal Company, Sydney Mines, N.S.

An up-to-date concrete products plant possessing excellent facilities is that of the National Concrete Manufacturing Company, Limited, Lindsay, Ont. (Mr. H. V. Pogue, President). Built on the G. T. R. main line to Toronto, this plant is claimed to be the most modern in the province for the manufacture of concrete pipe, building blocks, block silos, concrete fence posts and drainage tile. The company also supply special goods such as trimmings for public buildings. The raw material used is the best Portland cement and choice graded sand and crushed stone, so proportioned as to make the lowest percentage of voids and the strongest aggregate. The system of steam-curing employed by the company is the last word in curing concrete goods and is said to be more effective in 48 hours than "a month of weather." The company manufacture heavy railroad pipe in sizes from 12 in. to 36 in., according to specifications and all sizes of culvert and sewer pipe from 6 in. to 36 in. All

the larger sizes are reinforced to standard specifications and special reinforcing is given on application. The company's goods are made on cars which are run directly into steam kilns for 48 hours before yarding, leaving them ready for immediate shipment. The dimensions of the plant are 118 ft. by 84 ft. and the storage yard covers several acres.

Roofing Firm's Extensions

Messrs. Bird & Son, Hamilton, are now at work on an extensive addition to their present large plant. These additions are to take care of the increased demand for Neponset waterproof wallboard and for the Neponset shingle which the company is bringing out. Mr. George E. Messer, Canadian Manager for the company, states that the firm is erecting an addition to the plant which will cost about \$15,000, and will install machinery at a cost of about \$10,000. In addition to the various articles manufactured by the firm, it is the intention to place Neponset shingles on the Canadian market. These will be the first of the kind to be made in this country. The work of putting up the building will be rushed to completion as speedily as possible, and the hope is entertained that the new machinery which the firm will install will be in operation in a few weeks.

The company are sending a traveller to Australia, where he will spend a year in the hope of increasing the trade in that country. The traveller chosen for the work is Mr. H. F. Nobles, of St. John, N.B., who has covered the eastern Canadian route from the Hamilton office for the past two years. Mr. Nobles will go to London, Eng., where he will meet the European representatives of the company, and will then proceed to his destination.

Erratum.—The Aberthaw Construction Company, contracting engineers and concrete specialists, Boston, Mass., inform us that the building described in Fig. 30 of the illustrations accompanying the article, "The Descriptive Possibilities of Concrete," published in our issue of January 14 and 21 last, was that of the Pierce-Arrow Motor Car Company, Buffalo, and not that of the Packard Automobile Company, as described below the cut. The former building was built by the Aberthaw Construction Company in 1910.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Assiniboia, Man.

The contract awarded to the Bitulithic & Contracting, Ltd., 354 Main St., Winnipeg, has been rescinded. A meeting will be held by the municipal council shortly to re-let same.

Buckingham, Que.

The constructing of a reservoir is contemplated by the municipal council.

The municipal council will spend the sum of \$39,000 on the construction of 3¾ miles tar macadam roads, and \$12,000 on cement sidewalks.

Cannington, Ont.

The laying of cement sidewalks is being discussed by the town council.

Cayuga, Ont.

Tenders are called until noon March 2 for construction of 26½ miles stone macadam road in Haldimand County. Work to be let in three separate contracts. Contracts No. 1 and 2, situated on the Hamilton & Port Dover Plank Road; Contract No. 3, situated on Talbot Road. Tenderers are requested to examine localities of work. Plans and specifications at office of engineers, Jackson & Kyd, Dunnville. Clerk, T. A. Snider, K.C.

Chatham, Ont.

The city council proposes to lay concrete pavement between Park Ave. and Indian Creek Rd., at an estimated cost of \$12,344.

Esquimalt, B.C.

The municipal council has given instructions for the plans of the new sewerage system to be completed as soon as possible.

Estevan, Sask.

On March 1st the ratepayers will vote on by-laws for the installation of sewers and waterworks at a cost of \$68,000 and \$35,000 respectively. Engineer, H. V. Armstrong.

Edmonton, Alta.

The sum of \$880,536 for sewer construction was included in the estimates.

Emerson, Man.

Tenders will be called by the Municipal Council April 1st for cement sidewalks, estimated cost \$7,000.

Ft. William, Ont.

The city engineer, has been authorized to purchase 3 street sprinklers. A new 10 ton road roller is also required. Clerk, A. McNaughton.

The city council is considering the laying of macadam roadways.

Guelph, Ont.

The laying of a sewage system in St.

Patrick's Ward is under consideration by the city council.

Halifax, N.S.

The city council will lay permanent pavement on Argyle St.

Hamilton, Ont.

Estimates have been passed for the following pavements. Asphalt and wood block on Aberdeen, Herkimer, Queen and Main Sts.; asphalt on Victoria, McNab and Balmoral Sts.; asphalt macadam on Duke and Margaret Sts., and macadam on Catherine St.

Hanover, Ont.

The town council is considering the extension to the waterworks by the erection of a stand pipe and filtration system.

Kingston, Ont.

Tenders addressed to the City Engineer, R. J. McClelland, will be received until 3 p.m. Feb. 21, for excavation, drainage, track drainage, ballasting, surfacing and lining a double track railway, and for the paving of same on a concrete base, and for 18-in. outside of the outer rail. Also for excavation, concrete base and paving of balance of roadway to curb on King St. from Brock St. to the north side of Princess St., and Princess St. from King St. to the west side of Clergy street.

Lambton Co., Ont.

A mile of experimental roadway near Watford is contemplated by the county council. Further information can be obtained from Dr. Fairbank, Petrolia.

Leamington, Ont.

The town council will call tenders at once for cement or brick pavements and cement sidewalks.

London, Ont.

A by-law to raise the sum of \$39,000 for road improvements was passed by the Middlesex County Council.

Medicine Hat, Alta.

The sum of \$16,000 for 8 to 10 miles of new watermain, additional pumping unit and addition to new filtration plant was included in the estimates.

Moncton, N.B.

The city council has under consideration the laying of sidewalks and the construction of sewers, at a cost of \$25,000 and \$10,000 respectively.

The city council proposes to spend the sum of \$50,000 on permanent roadways.

Montreal, Que.

Tenders are being received by Board of Commissioners until March 3rd for construction of pumping station, wash water tower, superstructure of filter buildings, gate houses, etc., estimated cost \$150,000.

Norwich, Ont.

Plans and specifications for the pro-

posed waterworks system are at the office of the engineers, Bowman & Connor, Berlin, who will receive separate tenders for cast iron water pipe, hydrants and valves, excavation and pipe laying, turbine pumps and motors, elevated water tank. Driven well.

Napanee, Ont.

The expenditure of \$2,500 on sewers is proposed by the town council.

Niagara Falls South, Ont.

F. Junkinson, 195 Main St., Niagara Falls, proposes to install a small waterworks system.

Oak Bay, B.C.

Tenders addressed to the Reeve and Council will be received until noon Feb. 23rd, for the supply of about 230 tons cast iron pipe and specials. Specifications can be obtained from the acting engineer, E. H. Harrison.

The purchase of hydrants is contemplated by the municipal council.

Ottawa, Ont.

Tenders addressed to the Chairman Board of Control will be received until 4 p.m. Feb. 24th, for the supply of refined asphalt. Specifications at offices of engineer and MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Tenders will be received by the Chairman Board of Control until 4 p.m. Feb. 24th, for the supply of 12,264 lin. ft. cast iron pipes, also for special castings. Specifications at offices of engineer and MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Tenders for the supply of stone setts will be received by the Chairman Board of Control until 4 p.m. Feb. 24th. Specifications at offices of engineer and MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Tenders addressed to the Chairman Board of Control will be received until 4 p.m. Feb. 24th, for the supply of valves and 50 hydrants. Specifications at offices of engineer and MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Peterboro, Ont.

The city council is considering the construction of a sewer for service to the Dickson property at an estimated cost of \$6,947.

Preston, Ont.

The ratepayers will vote on by-law March 4th providing for the laying of one mile asphalt pavement on King St.

St. Catharines, Ont.

Tenders will be called by the city council March 1st for tile sewers, estimated cost \$30,000.

St. Hyacinthe, Que.

The city council is considering the purchase of the following water pipe, etc. 200 ft., 12 in. steel pipe; 400 ft., 10 in. steel

pipe; 260 ft., 12 in. cast iron pipe; 520 ft., 12 in. cast iron pipe; 1 check valve 12 in.; 2 check valves 10 in.; $\frac{1}{4}$ bend elbows.

Three Rivers, Que.

The question of sewer and watermain construction is engaging the attention of the Municipal Council.

The laying of macadam roadway and sidewalks is contemplated by the municipal council.

Toronto, Ont.

Tenders will be received by Mayor H. C. Hocken, chairman, Board of Control, until Feb. 17th, for sewers on following streets: Aziel, Barber, Caledonia, Gilmour, Heyworth, Highfield, Kenilworth, Lee, Maher, Mavety, McRoberts, Medland, Pacific, Rhodes, Swanwick, Vernon, Walmsley, Walter, Lyall and Midway district sewerage scheme outlet.

The Commr. of Works recommends the laying of asphaltic concrete pavement on both east and west sides of the Crescent from College St. to Bloor St. Estimated cost \$31,251.

Valleyfield, Que.

The municipal council proposes to spend the sum of \$20,000 on roads and walks. Work to be done by day labor.

Vancouver, B.C.

The municipal council has decided to extend the water main from the second beach around Stanley Park, and, ultimately, to encircle the entire park.

Plans have been prepared by Asst. Engineer Dalzell for resewering the East End Dist., between Jackson Ave. and Clarke Drive, at an estimated cost of \$10,000.

Wallaceburg, Ont.

Plans for the installation of a waterworks system have been prepared by Chipman & Power, engineers, Mail Bldg., Toronto.

Watford, Ont.

The town council are about to select material for the paving of Main St.

Winnipeg, Man.

Tenders will be received by the Board of Control until Feb. 10th for sewers in Borebank St., from Wellington Cres. to Academy Rd. In Seymour St., from Mountain to Machray Ave. Sec., M. Peterson. Engineer, H. N. Ruttan, 223 James avenue.

Tenders will be received by the Board of Control until Feb. 9th for sewers on Manitoba Ave., from Buller to Albany St. and in Magnus Ave. from Albany to Railway St.

Winnipeg, Man. (St. Vital)

Tenders addressed to the Reeve, Grandvital P. O., Man., will be received until 2 p.m. Feb. 18th, for the construction of approximately 8,808 ft. of concrete and 4,440 ft. of pipe sewers. Plans and further information at office of Engineer, L. G. Mullan, St. Mary's Road.

CONTRACTS AWARDED

Ft. William, Ont.

The following contracts have been awarded by the City Council. Year's supply of sewer tile, pig lead and lead pipe, awarded to W. S. Piper, 507-09 Victoria Ave.; waterworks supplies, Northern Engineering Co., Myles St.; valves and service boxes, Canadian Fairbanks-Morse Co., 26 Front St. W., Toronto.

Toronto, Ont.

The Board of Control has awarded the

contract for the construction of No. 2 sewerage outlet in West Toronto to the Commissioner of Works, R. C. Harris, \$55,200.

The Board of Control has awarded to the National Contracting Co., 9 Garnock Ave., the contract for the construction of the Annette St. Sewer at \$10,888.

A contract has been awarded by the Board of Control to the Connolly Agnew Constructing Co., 606 Avenue Rd., for Ossington Ave. and Hallam Street storm overflow sewer at \$36,780.

Toronto, Ont. (Weston)

A contract has been awarded by the Weston town council to Geo. Moogk, Weston, for the laying of lateral sewers at 40c. per ft.

Railroads, Bridges and Wharves

Ayr, Ont.

Plans and specifications are to be prepared for extensions to the bridge at an estimated cost of \$5,000. County Engineer, H. J. Bowman, Berlin.

Brantford Twp., Ont.

Tenders will be received by the engineers-in-charge, Jackson & Co., Temple Bldg., Brantford, Feb. 28th, for "White" bridge, over Fairchild's Creek, 5 miles east of Brantford. Steel bridge, 18 ft. roadway, 60 ft. span, estimated cost \$3,000; reinforced concrete abutments, 2202 yds., estimated cost \$3,000.

King's Co., N.S.

Bridges and culverts, estimated to cost \$16,000 to \$20,000, will probably be constructed by the county council during the current year.

London, Ont.

The G. T. Rly. Co. will construct a 2-mile extension to the Harris Farm, in the near future.

London Twp., Ont.

The township council proposes to construct the following concrete and steel bridges at the specified approximate costs: on Third St., one span, \$1,200; between Con. 7 and 8, one span, \$1,600; Con. 8, one span, \$2,600; between Con. 8 and 9, one span, \$1,350; between Con. 10 and 11, one span, \$1,500; between lots 38 and 31, Con. 11, one span, \$1,000; between Con. 13 and 14, one span, \$1,300; between Con. 14 and 15, one span, \$1,650; Con. 15, one span, \$1,000; between Con. 16 and 17, one span, \$1,400.

Nicollet, Que.

Tenders for wharf construction, addressed to R. C. Desrochers, Sec. Pub. Works Dept., Ottawa, will be received until Feb. 26th. Plans, etc., at office of Dept., Ottawa.

Ottawa, Ont.

The city council proposes strengthening the Sussex St. Bridge so that double trolley cars can operate. New steel stringers and bents, also steel floor beams will be required.

Funds are being raised for the construction of a steel bridge at Main St., 60 ft. wide, to carry electric cars. K. A. Hurdman, 17 Elgin Street, V. V. Rogers, 195 $\frac{1}{2}$ Sparks St., and B. Slatery, 40 Riverdale Ave., are interested.

Port Haney, B.C.

The ratepayers have petitioned the

Government for a new bridge, to be built over Lillooet river.

St. John, N.B.

The general contract for the wharf has been taken from Connelly & Charleston and given to the following: Maritime Dredging Co., c/o W. B. Tennant, King St.; concrete work, E. G. M. Cape, 10 Cathcart St., Montreal; piling, A. R. C. Clark & Son, 51 Water St.

Vancouver, B.C.

Plans have been prepared for the construction of a causeway at Coal Harbor, at an estimated cost of \$200,000. The work will be started when a selection is made between the engineer's and the "Mawson" plans. Engineer, F. L. Fellowes.

Tenders close at the city hall on March 5th, for the construction of viaducts at Hastings, Pender, Keefer and Harris Sts. The work will probably only be done on Hastings and Keefer Sts. viaducts at present. City Engineer, F. L. Fellowes.

Victoria, B.C.

The Can. Northern Rly. Co. have under consideration the construction of 3 car ferries to operate between Vancouver Island and the mainland.

Winnipeg, Man.

Plans have been drawn for the Winnipeg & St. Boniface Harbor Commsn., Winnipeg, for the construction of three docks situate in North Winnipeg, Centre Winnipeg and St. Boniface, respectively, and a deputation will interview the Dom. Govt. in regard to financing this project.

Public Buildings, Churches, Schools, etc.

Bassano, Alta.

The sum of \$25,000 was included in estimates for a public building.

Bredenburg, Sask. (Sunnyside)

Work on the erection of the Roman Catholic Church will be started this year.

Broadview, Sask.

Tenders for the erection of a town hall will be called by the town council in April if funds can be raised; estimated cost \$25,000.

Brockville, Ont.

A new building will be erected by the School Board in the north ward.

Castor, Alta.

The sum of \$20,000 was included in the estimates for public buildings.

Charlottetown, P. E. I.

Tenders for an orphanage building will be received by Rev. L. J. MacDonald, City Hospital, until Feb. 21st. Plans and specifications at Bishop's residence, Charlottetown, and at the Parochial House, Summerside. Estimated cost \$25,000.

Chatham, Ont.

It is proposed to build an addition to the Queen Mary School. Dr. T. L. McRitchie, Chairman, Board of Education.

Eastview, Ont.

The erection of a Sunday school building is being considered by the Presbyterian Church Congregation.

Estevan, Sask.

Plans for the new hospital having been

drawn, the town council will receive tenders about March 1st.

Plans for the erection of an armoury, on Third St., have been drawn.

Plans having been prepared, tenders for the erection of the Roman Catholic Church will be called about March 1st. Architects, Fortin & Buchanan, Regina, Sask.

Edmonton, Alta.

The sum of \$100,000 was included in estimates for addition to post office.

The sum of \$75,000 was included in the estimates for 1914 for the erection of a customs examining warehouse.

Fort William, Ont.

Finnish Co-operative Society have plans in progress for a new \$20,000 hall on Simpson street.

Goderich, Ont.

The Alexandria Marine & General Hospital authorities have purchased a site, and the council will be asked to submit a by-law granting \$15,000 for building purposes.

Hamilton, Ont.

Plans in progress for the new Y. M. C. A. building on Main St. W., and tenders will be called shortly. Architects, Mills & Hutton, 804 Bank of Hamilton Bldg.

Mt. Hamilton, Ont.

St. Stephen's Anglican Church Congregation propose to build a new Sunday school.

High River, Alta.

The sum of \$20,000 was included in the estimates for 1914 for the erection of a public building.

Indian Head, Sask.

Plans are in progress for a forestry office which the Public Works Dept. will erect at an estimated cost of \$19,000.

Ingersoll, Ont.

A site has been purchased on Charles St. and plans are being drawn for the erection of an armory estimated to cost \$59,000.

Kamloops, B.C.

As the original plans for the drill hall were found to be unsuitable, the public Works Dept. is preparing a new set.

The sum of \$85,000 was included in this year's estimates for the erection of a new post office building.

Kingston, Ont.

Tenders for the erection of a college at the corner of Russell and Thomas Sts., for the Regiopolis College Board, will be received by Wm. Newlands & Sons, architects, Bagot St., until Feb. 28th. Estimated cost \$40,000.

London, Ont.

The proposed labor temple for the Arbeiter Ring will not be gone on with at present.

Macleod, Alta.

The sum of \$25,000 was included in the estimates for 1914 for the erection of a public building.

Montreal, Que.

Plans are in progress for the erection of a church at the corner of St. Urbain and St. Viateur Sts., for St. Michaels

Parish. Beauprand, Champagne and Chenevert, architects, 182 St. Catherine E., expect to call tenders about April 1st.

Tenders for the school and chapel for the Parish of St. Mark will not be received by J. Bigonnesse, 92 Notre Dame E., architect, before March 1st.

The Young Men's Hebrew Association, Pres., J. Goldstein, St. Urbain St., propose erecting a new club house.

Montreal, Que. (Longue Pointe)

Tenders for a fire station will be received by Board of Commissioners, L. N. Senecal, secretary, until Feb. 12th. Estimated cost \$50,000.

Medicine Hat, Alta.

The city council has included in the estimates a sum of \$60,000 for the erection of two fire stations.

It is expected that the plans for the High School on Fifth Ave. will be completed this month by the architects, McCoy & Levine, in order that the building may be erected this year.

Mitchell, Ont.

A school to cost \$30,000 is proposed by the School Board and further information can be had from secretary.

Nakusp, B.C.

A hospital building is contemplated by the Municipal Council and a Committee will be formed to look into the matter. A sum equivalent to that raised by citizens will be granted by the provincial government.

Nanaimo, B.C.

A site has been selected for the erection of the city hall building. Estimated cost \$50,000.

North Augusta, Ont.

Tenders for the erection of a two-story school building will be received by the School Board Sec. until Feb. 21st.

Ottawa, Ont.

Certain alterations and improvements to the market building, on George St., are contemplated by the city council.

Separate tenders for the erection of the new Glebe Methodist Church will be received by C. J. Burritt, architect, 193 Sparks St., until 5 p.m. Feb. 16th.

Tenders are to be called shortly for the new Billings Bridge Pres. Church. Architect, J. Albert Ewart, 193 Sparks street.

First Baptist Church Congregation intend to make their proposed church self-sustaining by also erecting stores and apartments. A committee has been appointed consisting of W. E. Matthews, 221 Clemow, Gordon Edwards, 55 McKay, H. T. Ross, 411 Queen St., Hector McDonald, 65 Robert St., J. H. Nunn, 83 Florence. Secretary, Douglas Winter, 47 Frank St. Estimated cost \$130,000.

Red Deer, Alta.

The sum of \$25,000 was included in estimates for a public building.

Regina, Sask.

The erection of a receiver's gen. office, at a cost of \$75,000, is being considered by the Public Works Dept.

Saanich, B.C.

Two new schools and a number of ad-

ditions are to be provided for in the estimates for 1914.

Sherbrooke, Que.

The Board of Protestant School Commissioners has issued a circular asking for the consent of ratepayers for the expenditure of \$40,000 on the erection of a new school.

Stratford, Ont.

Lindsay & Brydon, architects, 65 Victoria St., Toronto, are open to receive tenders for the erection of a church for Knox Presbyterian Church Congregation.

St. John, N.B.

Tenders for the erection of the tuberculosis hospital will be received by J. King Kelley, Walker Bldg., Prince William St., and the architect, F. Neil Brodie, 42 Princess street.

Tenders for the painting of the post office will be received by Rhodes Curry Co., Amherst, N.S., general contractor, until Feb. 16th.

Toronto, Ont. (Swansea)

The Swansea Public School Board intend making a 6-room addition to the present building.

Toronto, Ont.

Chief Librarian Locke, in a report to the Board, states that a new central circulating library is necessary.

Property Commr. D. Chisholm has been instructed to purchase additional land for the proposed extensions to Keele street police station.

Chief Librarian Locke, of the College St. Library, advises the addition of a wing to present building.

The estimates include \$2,000 for offices on the 4th floor and \$5,000 for offices in attic at the city hall.

Property Commr. D. Chisholm recommends a new building to accommodate Police, Women's and Juvenile Courts.

The Board of Education recently passed a motion empowering the Property and Finance Com. to negotiate for a new site on Bloor St. for a collegiate institute.

Tenders will be received by F. F. Rhoder, Sec. Separate School Board, 34 Duke St., until Feb. 17th, for plumbing, heating and ventilation at St. Helen's and St. Cecilia's Schools. Plans, etc., at office of Engineer, C. T. Wilson, 79 Adelaide St., E.

South Vancouver, B.C.

The sum of \$25,000 was included in estimates for 1914 for school additions.

Vegreville, Alta.

The sum of \$30,000 for a public building was included in the estimates.

Vermilion, Alta.

The sum of \$20,000 was included in estimates for a public building.

Vernon, B.C.

A committee consisting of W. G. Simpson, J. I. Beatty and Jno. Thomas, was appointed to report on the proposed construction of a public bath.

Victoria, B.C.

A new library building is being considered by the city council.

The Y. M. C. A. authorities are raising a fund of \$150,000 for the erection of a

new building for which D. C. Frame, 206 Libben-Bone Bldg., is drawing plans.

Wainwright, Alta.

The sum of \$20,000 was included in estimates for public buildings.

Wallaceburg, Ont.

Tenders for the erection of a school will be received by T. F. Hinnegan, Wallaceburg, on behalf of the Separate School Board, until Feb. 21st.

Watford, Ont.

A post office site has been purchased, and plans may be seen at the office of Reeve, Stapleford.

Winnipeg, Man. (St. Boniface)

J. A. Senical, 43 Masson Ave., St. Boniface, will have plans ready by March 1st, for the new St. Boniface Hospital.

Woodstock, Ont.

The town council is considering the construction of public lavatories.

The erection of public drinking fountains is engaging the attention of the town council.

CONTRACTS AWARDED

Halifax, N.S.

The following contracts have been awarded in connection with the erection of the Dalhousie University Library. General contractors, masonry, carpentry, iron and steel, roofing, Falconer & McDonald, 59 Granville St.; painting, Frank Reardon, 42 Barrington St.; heating, Farquhar Bros., Ltd., 16 Barrington St.; electrical, J. Starr, Son & Co., Ltd., 158 Granville St.

Montreal, Que.

The contract for the erection of the Foundling Hospital, on St. Urbain St., has been awarded to Anglins, Ltd., 65 Victoria street.

Ottawa, Ont.

The following sub-contracts have been awarded in connection with the erection of the customs house on Essex St. Steel work, Toronto Structural Steel Co., Ltd., Atlantic Ave., Toronto; granite, La Compagnie de Granite de Megantic, Que.

Quebec, Que. (Mastai)

The contract for the erection of the isolation hospital has been awarded by the city council to General contractors, Villeneuve & Son, 277 Prince Edward St., \$90,342. The amount of contract includes entire construction, 3 storeys, 110 x 30, cut stone and brick.

Toronto, Ont.

A contract for cabinet work in Perth Ave. and Fisher Schools and Humber College Institute, has been awarded by the Board of Education to Deisenroth Contracting Co., Adelaide E., \$1,054.

J. D. Macdonell & Co. has been awarded the contracts for prism lights at Regal School for \$245, and Riverdale High School for \$560.

Business Buildings and Industrial Plants

Bobcaygeon, Ont.

The Bank of British North America proposes to erect a branch here.

Calgary, Alta.

Tenders are to be called shortly for a

\$500,000 theatre on 8th Ave., for Starland Ltd., Starland Bldg., Winnipeg. Architect, O. C. Grass, c/o H. L. Stephens & Co. The work on raising old buildings will commence about March 1st.

Camrose, Alta.

The Imp. Oil Co., Edmonton, has secured a warehouse site near the C. P. R. station.

Edmonton, Alta.

The Great Northern Tannery Co., Ltd., N. Edmonton, proposes to double the capacity of its plant. New machinery will be required.

The city council is considering the erection of a garage at an estimated cost of \$10,000.

Estevan, Sask.

The Great West Coal & Brick Co., 2nd St., have plans in progress for a brick plant, 175 to 200 h.p. electricity plant will be installed, and machinery is required.

H. E. McKenzie, architect, is drawing plans for a \$10,000 store on 4th St., for D. A. McNeil.

Fort William, Ont.

M. H. Braden and T. E. Dean have purchased a site with 100 ft. frontage on Syndicate Ave. for the erection of stores and offices.

Hamilton, Ont.

Watt & Blackwell, architects, Lister Chambers, have plans in progress for 3 stores and apartments on King St. E. for Bennett & Thwaites, 11 Holton Ave. Estimated cost \$20,000.

Maple Creek, Sask.

Gilbert Hunt Mfg. Co. will erect a \$75,000 factory on Jasper St. for the manufacture of all kinds of machinery and farming implements. Power will be supplied by the Maple Creek Lighting, Power and Milling Company.

Montreal, Que.

Tenders for a factory to cost \$100,000, for the Tuckett Tobacco Co., Ltd., Hamilton, will be received until Feb. 13th, by architect, c/o owners.

Brown & Vallance, Canada Life Bldg., architects, will call tenders about March 1st for stores, etc., for Jaeger's Sanitary Woolen System Co., Ltd., 316 St. Catherine W.

Belding, Paul & Corticelli, Ltd., 185 Shearer St., have appointed H. C. Stone, 84 St. Francois Xavier St., architect, for their new building.

Martin-Senour Co., Ltd., have decided to do nothing towards the proposed paint factory for another year.

Montreal, Que. (Lachine)

Messrs. Daly & Morin, St. Paul St., have put a proposition before council, and if same is passed, will go ahead at once with extensive alterations to their plant.

Montreal, Que. (Westmount)

Tenders for addition to club and house of the Westmount Bowling Club, Kensington Ave. and Sherbrooke St., will be received until Feb. 14th by Hutchison, Wood & Miller, Royal Ins. Bldg.

Moose Jaw, Sask.

Tenders will be called shortly for a theatre with a seating capacity of 500, for the Garrick Theatre Co. Architects.

Reilly, Dawson, Hancock & Reilly, Room 20, Russell Block.

Napanee, Ont.

Gibbard Furniture Co., Dundas St., propose building a factory at a cost of \$10,000.

Cliff Bros. are considering the erection of a condensed milk factory, at a cost of \$40,000.

Ottawa, Ont.

The Mutual Owners' Assn. propose constructing a garage in the Sunnyside Hill Dist. The building will accommodate 180 cars.

Owen Sound, Ont.

Should the extensions proposed by the Doric Cement Co. be made, strongest crushing machinery will be installed, and in addition, the present burning mills or rotaries will be exchanged for 10 ft. diameter burners. To accommodate these, new units for the plant would have to be constructed.

Port Arthur, Ont.

Plans are being prepared for a \$100,000 5-storey business building for The Alberta Land Co.

Port Haney, B.C.

C. T. W. Piper, Burnaby, is negotiating for a site east of the Haney Brick Co.'s Works, for the erection of a shingle mill.

Prince Rupert, B.C.

A site of 240 acres has been secured at Porpoise Harbor by B. C. Fisheries, Ltd., 602 Hastings St. W., Vancouver, for the erection of an ice and cold storage plant.

Regina, Sask.

Plans for a warehouse for Campbell, Wilson and Strathdee, Dewdney and Rose, are being drawn by J. H. G. Russell, 1110-1111 McArthur Bldg., Winnipeg, and tenders will be called in the spring.

Sherbrooke, Que.

Plans have been drawn for a moving picture theatre and apartment building, to cost \$25,000, for Albert Leclerc, Bowan Avenue. Architect, Frank LeFebvre, 119 Wellington St., who will receive tenders.

Sudbury, Ont.

W. H. Owens, Room 18, Baikie-Gill Block, will probably call tenders about March 1st, for a \$20,000 store and apartment building for Messrs. Wilson and Greenwood.

W. H. Owens has plans in progress for store and apartments on Cedar St., for S. Jessop, at a cost of \$20,000.

St. John, N.B.

Arthur Mellick, 29 Duke St., is interested in a Syndicate, formed for the construction of a theatre and stores. Private tenders will be received for a month.

Toronto, Ont.

Parks Commr. Chambers will report to the Parks Committee on the proposal of F. R. Ginn, to build a theatre on Centre Island.

Tenders are still open for the erection of a theatre on Victoria St., for C. H. Miles, Cleveland, Ohio, no date being set for closing. Architects, Neville & Bagge, 217 W. 125th St., New York.

Tenders are called for 4 stores and

apartments by J. A. Thatcher, in trust, 31 Queen St. W., to cost \$48,000, on Gerrard and Morley Ave.

Property Commr. D. Chisholm has recommended that a cold storage plant be installed at the new abattoir, estimated cost \$36,000. The Board of Control will probably call for tenders at once.

The Property Committee has instructed Commr. D. Chisholm to negotiate for the purchase of land for a Women's Industrial Farm.

Windsor, Ont.

Heintzman & Co. will probably make certain alterations to their factory on Ouellette St., at a cost of \$5,000.

Tenders for the factory and power building for the No-Draught Ventilator Co., are in, but contracts are not yet awarded.

Winnipeg, Man.

Burroughs, Stewart & Milne Co., St. James St. E., propose adding 4 storeys to their warehouse at an estimated cost of \$20,000. Architect, D. W. Bellhouse, Canada Block.

CONTRACTS AWARDED

Estevan, Sask.

The following contracts have been awarded in connection with the theatre for Newcomb & McKenzie. General contractor, mason, carpentry, roofing, painting, interior fittings, H. E. McKenzie, 4th St.; iron and steel, Manitoba Iron & Steel Co., Winnipeg; heating, plumbing and electrical, Gallagher & Walker, 3rd Ave., Weyburn. Contract for seating not yet awarded.

Fort William, Ont.

The contract for addition and alterations to the "Times Journal" newspaper plant has been awarded to M. H. Braden.

Hamilton, Ont.

The contract for masonry in connection with the 3 stores and apartments on Barton St., for W. R. Turnbull, has been awarded to Geo. E. Mills, 614 King E. Other trades to be let shortly.

The following sub-contracts for alterations to Stroud Hotel, Merrick St., have been awarded. Plastering, Hannaford Bros.; heating, Adam Clark; electrical, Pottier & Bizley; painting and interior fittings not yet let.

Montreal, Ont.

The contract for alterations to office building of the Boxer Estate, Hospital St., has been awarded to C. E. Deakin, 41 Mayor.

Peterboro, Ont.

The following sub-contracts have been awarded in connection with the remodeling of the National Hotel: Plumbing, Geo. Brenton, Hunter and Queen Street (contract includes 70 lavatories, 20 baths, etc.); electric wiring, Alexander & Miller, 438 George St.

Toronto, Ont.

The following contracts have been awarded in connection with the hydrogen building for Lever Bros., Eastern Ave. Mason, Cannon & Son, 75 Brick Ave.; sheet metal and roofing, W. C. Gurney, 4 Spruce St.; steel sash, A. B. Ormsby & Co., King W.; structural steel, McGregor & McIntyre, 1139 Shaw; plumbing, Robt Long & Son, 79 Richmond E.

painting and glazing, J. McCausland & Son, 11 Nelson St.

Vancouver, B.C.

The contract for the foundation of the cold storage warehouse for the Vancouver-Prince Rupert Meat Co., has been awarded to E. J. Ryan, 568 Granville St., who is receiving tenders for sand, gravel and cement for foundation. Tenders for general contractor will be called shortly, and separate tenders invited for cold storage equipment.

Windsor, Ont.

The following sub-contracts have been let in connection with the Remington Arms Co. factory on Tecumseh Road: General contractors, Wells & Gray, Manning House Block; metal work and plumbing, Pennington & Brian, 47 Sandwich St. W.; electrical work, Dominion Electric Co., 4 Pitt St. W.

Residences

Edmonton, Alta.

Plans are being prepared for an apartment block, 8th St. and Victoria Ave., for Jno. Ross & Son, 40 Jasper Ave. W. Architects, Van, Siclen & Macomber, 314 Alexandra Block. Estimated cost \$180,000.

Hamilton, Ont.

Plans for an apartment house, on Bay St., to cost \$30,000, are being drawn for McPhie & Donaldson, by McPhie, Kelly & Darling, Bank of Hamilton Bldg.

F. W. Warren, Bank of Hamilton Bldg., architect, will be ready to receive tenders about Feb. 18th for the residence to cost \$7,000 for J. H. Horning, Blake Street.

Jas. Bryers, Wilson & Gibson Ave., is considering the erection of 50 2½-sty. brick residences on Glendale Ave.

The erection of 20 2½-storey residences on Proctor Blvd., is being considered by F. H. Gage, 860 King E.

Leamington, Ont.

Tenders for residence and pavilion to cost \$7,000, are called by the town council. Clerk, R. M. Selkirk.

Medicine Hat, Alta.

Plans are in progress for an apartment house to cost \$40,000, on 4th Ave., for Thos. Montgomerie, Hull Block.

Montreal, Que.

Turner & Carless, Board of Trade Bldg., architects, are receiving tenders until Feb. 14th, for general contractor and also for sub-contracts, for the erection of a \$30,000 residence at the corner of Chomedy and Comte Sts., for Mr. S. C. Skelton.

Plans are in progress for an apartment house, on St. Urbain, to cost \$18,000, for M. Waxman, 213 Laval Ave., who will call tenders immediately on masonry, carpentry, brick, plumbing, heating and electrical.

Tenders for a residence, on St. Louis Sq., for Jas. Monnette, are being received by L. R. Mont Briant, 230 St. Andre St., for all sub-contracts but brick.

Montreal, Que. (Outremont)

Plans are in progress for an apartment, to cost \$50,000. L. A. Beauchemin, 402 Bleury St., will call tenders for all sub

trades but floors and brick, about March 1st.

Sketches have been drawn by Doucet & Morissette, architects, 360 St. Catherine E., for the erection of a \$30,000 apartment house for Mr. Blais, Ahuntsic, Que.

Montreal, Que. (Westmount)

J. H. Hand, 609 Belmont who is building a number of residences on Grosvenor St., is receiving additional tenders for roofing.

Ottawa, Ont.

Plans having been completed, two, seven door tenement houses are to be erected for A. L. Florence at a cost of \$35,000, at the corner of Sussex, Drive-way and McTaggart Sts. Herbert Shleacow, architect, Room 45, Sparks Chambers. Alexander and Campbell, general contractors. Houses to be completed for the 1st of May. Three storeys, stone foundation, brick veneer construction, plastering, hot air heating, electrical lighting, tile work and plumbing.

Plans have been drawn for a residence on Clemow St., for John Foley, Central Chambers, and tenders will be called for various trades.

Port Mann, B.C.

The Canadian Northern Railway will commence work at once on the erection of 100 residences and other improvements.

Port Perry, Ont.

Two residences will be built by the Carnegie Milling Co., Water St., at a cost of \$6,000.

Regina, Sask.

A. Black, 17 Black Block, is considering the erection of 16 residences at a total cost of about \$60,000.

Sherbrooke, Que.

Plans have been drawn for an \$8,000 residence on Minto Street for Ignace Croteau, 42 Aberdeen.

F. Lefebvre, 119 Wellington St., has plans in hand for a tenement house on Marquette St., for Mr. Arthur Cote.

Sudbury, Ont.

W. H. Owens has plans in hand for a residence near College St. for Dr. W. C. Morrison.

Toronto, Ont.

J. M. Cowan, 65 Adelaide E., has sketch plans drawn for a 5-sty. apartment house on University Ave.

R. Cruse, 20 Hendrick Ave., who is erecting 3 residences on Hendrick St., will sub-let plastering, painting, heating, plumbing and electrical fittings.

Plans for one pair residences on St. Clarens have been drawn for H. Galbraith, 17 Rusholme Park.

C. H. Gould, Hillsdale, Ont., is inviting tenders for the erection of an apartment house in the Parkdale district.

Tenders for 4 residences, on Balsam Ave., for R. H. Bullen, 79 Wilson Ave., will be received by J. A. Thatcher, 31 Queen St. W., architect, for all trades except brick and carpentry.

Tenders for 4 attached residences, on Cowan Ave., will be received by J. A. Thatcher, 31 Queen W.

In connection with the apartment
(Continued on page 80)

Tenders and For Sale Department

TOWNSHIP OF BRANTFORD

White Bridge Contract

Sealed tenders, clearly endorsed on the outside "Tender for Superstructure," will be received by the Township of Brantford up to noon on Saturday, 28th February, 1914, for the manufacture and erection of a "Class C" steel highway bridge with 18-foot roadway and a clear waterway of 80 feet over Fairchild's Creek on the Hamilton Rd. Specifications and instructions to bidders may be had from Jackson & Company, Temple Building, Brantford.

Tenders should be addressed to the Township Clerk, County Buildings, Brantford.

ALAN MAIR JACKSON,
Township Engineer.

6-7



Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, February 17th, 1914, for the construction of the following sewers, viz.:-

Aziel St., from Annette St. to Humberside Ave.
Barber Avenue, Maher St. to Annette Street.
Caledonia Rd., from St. Clair Ave. to 300 feet north of Innes Avenue.

Danforth Ave., Main St. to East City Limits.
Gilmour Ave., Dundas St. to Annette Street.
Heyworth Cres., Kingston Road to Woodbine Avenue.

Highfield Rd., Gerrard St. to Walpole Ave.
Kenilworth Ave., 277 ft. south of S.S. Norway Place to S.S. Kingston Road.

Lane first west Crawford Street, Harbord St. to lane second south of Bloor Street.

Lappin Avenue and Hallam Street Overflow Sewer, from Lappin Avenue and Emerson Ave. to Hallam Avenue and Salem Avenue, via Lappin Avenue, Dufferin Street and Hallam Avenue.

Lee Avenue, 1,568 ft. north of N.S. Queen Street to S.S. Kingston Road.

Lyall Avenue, Main Street to Wayland Ave.
Maher Street, Gilmour Ave. to Runnymede Rd.
Mavety Street, Dundas St. to Humberside Ave.
McRoberts Ave., St. Clair Ave. to N.S. Innes Avenue.

Medland Street, Dundas St. to Humberside Ave.
Midway District Sewerage Scheme Outlet, from Gillard Avenue and Felstead Avenue to Danforth Avenue and Hillingdon Avenue, via Felstead Ave., Ashdale Ave., and Danforth Ave.

Pacific Ave., Annette St. to Humberside Ave.
Rhodes Ave., Gerrard St. to Danforth Ave.
Swanwick Ave., Norwood Ave. to Wayland Ave.
Vernon St., Runnymede Rd. to Gilmour Ave.
Walter St., Kingston Rd. to Lyall Ave.

Walmesley Blvd., Baker Ave. to Lawton Ave.
Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved by the City Treasurer, not members of the City Council or Officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, February 5th, 1914.

6

TENDERS

Bulk and separate tenders will be received until February 25th for the erection of Knox Church, Stratford, Ont. Plans may be obtained upon depositing marked cheque for Thirty Dollars with the Architects. Cheque returnable upon opening of bona fide tenders.

LINDSAY & BRYDON, Architects,
65 Victoria St., Toronto, Ont.

6

Tenders for Cement Walks

Tenders will be received by the undersigned, until 6 p.m. Saturday, February 28th, 1914, for the construction of certain Granolithic Walks in the Town of Sudbury.

Approximating 8240.9 lineal feet.

Locations, specifications and forms of tender may be obtained by application to Town Clerk, Sudbury.

Tenders to be sealed and marked "Tenders for Cement Walks."

The lowest or any tender not necessarily accepted.

Marked cheque for five per cent. of value of work to accompany tender.

Granolithic walks other than above are in contemplation for the season of 1914.

Dated at Sudbury this 29th day of January, 1914.

W. J. ROSS, Town Clerk.

CITY OF MONTREAL

Direction of Public Works Water Department

Sealed tenders endorsed "Tender for Filtration Plant, Construction of Buildings," addressed to the Board of Commissioners, will be received up to noon of Tuesday, March 3rd, 1914, for the construction of the following works, forming a portion of the Filtration Plant of the City of Montreal.

1. Pumping Station, Wash Water Tower, Superstructures of Filter Building and Gate Houses Nos. 1, 2, 3, 4, 5, 6, and 7 and appurtenances.
- 1a. Alternative price if superstructure of buildings are built of brick instead of concrete.
2. Additional earth work, 1,000 cubic yards.
3. Additional concrete, 100 cubic yards.

Plans and specifications may be seen at the office of the Chief Engineer of Public Works of Montreal at the City Hall, and at the offices of Hering & Fuller, 170 Broadway, New York City, and of the Contract Record and Engineering Review, Toronto. Copies may be obtained upon depositing \$25 to cover cost of same, which sum will be refunded to bona fide tenderers and others returning plans, etc., in good condition before the closing date for receiving tenders.

No tender will be considered unless made on the blank form supplied, and unless accompanied in the same envelope by a certified cheque for \$15,000 on a chartered bank of the Dominion of Canada, payable to the City Treasurer at the City of Montreal.

Tenders will be opened in the presence of the interested parties by the Board of Commissioners at noon of March 3rd, 1914.

The Board of Commissioners reserve the right to reject the lowest or any tender.

By order of the Board of Commissioners,
L. N. SENECA, Secretary.

Commissioners Office,
City Hall, Montreal, Que.
February 2nd, 1914.

11-18

CITY OF KINGSTON

Tenders for Pavements

Sealed tenders addressed to the undersigned and endorsed "Tenders for Pavement," will be received up to 3 o'clock p.m., Saturday, February 21st, 1914, for the Excavation, Drainage, Track Drainage, Ballasting, Surfacing and Lining a double track railway and for the paving of same on a concrete base and for eighteen inches outside of the outer rail. Also for the excavation, concrete base, and the paving of the balance of the roadway to the curb, on King Street from Brock Street to the north side of Princess Street and Princess Street from King Street to the west side of Clergy Street.

Plans and specifications for the above works, exclusive of the pavement, may be seen and all other information obtained at the office of the undersigned.

The tenderer will submit with his tender a copy of the specifications of the pavement or wearing surface he proposes to lay, also unit prices for the different works and per square yard of pavement complete.

Approximate quantity of pavement 11,000 square yards.

A marked cheque for five per cent. of the amount of the tender must accompany each bid.

The lowest or any tender not necessarily accepted.

R. J. McCLELLAND,
City Engineer.
February 2nd, 1914.

5-6

To Bridge Contractors

Second Narrows Bridge

Vancouver, B. C.

The Burrard Inlet Tunnel & Bridge Company, 513-514 Carter Cotton Building, Hastings Street, Vancouver, B.C., are prepared to receive tenders for the construction of a Bridge across the Second Narrows of the Burrard Inlet to connect the City of Vancouver and the Municipality of North Vancouver by means of a single line of steam track, two lines of electric car track, two lines of roadway and a footway, together with the necessary approaches thereto, as well as the machinery for working the opening span of the Bridge and other incidental works.

The contract drawings, specifications and schedule of quantities may be seen on and after 21st of January at the offices of the Consulting Engineers, Sir John Wolfe Barry, Lyster & Partners, 2 Queen Anne's Gate, Westminster, England, on and after 19th January at the offices of the company's agents, Messrs. Pringle & Guthrie, Citizen Building, Sparks Street, Ottawa, Ont., and on and after 26th January at the offices of Messrs. Cleveland & Cameron, Civil Engineers, 1001-1010 Rogers Building, Granville and Pender Streets, Vancouver, B.C., between the hours of eleven and four (Saturdays excepted) in each case.

Copies of the drawings, specifications, schedule of quantities and form of tender may be obtained at each of the above offices upon payment of \$100 in Canada and £21 in England, which fee will be returned on receipt of a bona fide tender accompanied by the specification and drawings which are to be returned with the tender.

Tenders endorsed "Tender for Second Narrows Bridge," must be delivered under seal addressed to the Secretary of the Burrard Inlet Tunnel & Bridge Company on or before noon on Wednesday, the 1st day of April, 1914.

The lowest or any tender will not necessarily be accepted.

EUSTACE J. COCKRELL,
Secretary of the Company

5-7

Stone Macadam Road

Sealed tenders will be received up to noon on the 2nd day of March, 1914, by the undersigned at Cayuga, Ont., for the construction of twenty-six and one-half miles of stone macadam road in the County of Haldimand. The work will be let in three separate and distinct contracts, not necessarily to the same individual. Tenderers should tender for each contract separately. The work to be done on Contracts Nos. 1 and 2 is situated on the Hamilton and Port Dover Plank Road, and that on Contract No. 3 is situated on the Talbot Road. Each section has convenient shipping points.

Tenderers are requested to examine the localities of the work and plans and specifications for the same may be seen at the office of the County Engineers, Messrs. Jackson & Kyd, Dunnville, or may be had from them on the payment of \$10.

Lowest or any tender not necessarily accepted.

T. A. SNIDER, K.C., County Clerk.
County of Haldimand, Cayuga, Ont.

5-8

CITY OF BRANTFORD

Tenders for Sewer Pipe

Sealed tenders, addressed to Alderman George Ward, Chairman of the Board of Works, in care of the City Clerk, Brantford, Ont., will be received till twelve o'clock noon, on Thursday, February 19th, 1914, for the supply of sewer pipe required by the City of Brantford during 1914.

Specifications may be seen and instructions of bidders and forms of tender obtained on application to the City Engineer.

Each tender must be accompanied by a marked cheque, payable to the order of the City Treasurer, for the amount called for in the form of tender.

The lowest or any tender not necessarily accepted.

T. HARRY JONES, City Engineer,
City Hall,
Brantford, Ont.

February 9th, 1914.

6



Sealed tenders addressed to the undersigned, and endorsed "Tender for 2nd Extension of New Breakwater, Port Arthur Harbour, Ont.," will be received at this office until 4 p.m. on Monday, March 2, 1914, for the construction of an Extension to what is known as the "New Breakwater" in the Harbour of Port Arthur, Thunder Bay and Rainy River District, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Building, Toronto, Ont., Port Arthur, Ont., Post-Office, Montreal, and Post Office, Quebec.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, January 27, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department. 5-6-10

AGENTS WANTED FOR CONCRETE MIXERS

A large Canadian firm about to manufacture concrete mixers on an extensive scale wants sales agents in Ontario, Quebec, Maritime Provinces, Winnipeg, Calgary, Vancouver. Apply Box 962, Contract Record, Toronto. 6-8

Notice to Contractors Water Works Supplies

Sealed tenders addressed to the Chairman of the Waterworks Committee, City Hall, Ottawa, will be received by the Secretary of the Waterworks Committee, up to 4 p.m., Tuesday, February 24th, 1914, for the supply and delivery of Brasswork, Special Pipe Castings, Hydrants, Cast Iron Pipe, Lead Pipe and Pig Lead, Valves, Oils and Grease as the case may be.

Specifications, form of tender and full particulars may be obtained on application at the City Engineer's Office, City Hall, Ottawa.

Any tender received after the above stated time will be declared informal.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,

City Engineer.

Ottawa, February 6th, 1914.

6-7

Notice to Contractors Civic Supplies

Sealed tenders addressed to the Chairman and Members of the Board of Control, City Hall, Ottawa, will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., Tuesday, February 24th, 1914, endorsed "Tender for Broken Stone, Brick, Stone Setts, Cement, Plank and Cedar, Sand, Asphalt, Castings, Street Sweepers' Brooms, Street Sweepers' Buckets and Carts, or Draughting Supplies," as the case may be.

Specifications, form of tender and full particulars may be obtained on application at the City Engineer's Office, City Hall.

Any tender received after the above stated time will be declared informal.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,

City Engineer.

Ottawa, February 6th, 1914.

6-7



Mail Contract

Sealed tenders, addressed to the Postmaster General, will be received at Ottawa until noon, on Friday, the 20th of March, 1914, for the conveyance of His Majesty's mails, on a proposed Contract for four years, six times per week each way, over Locust Hill (via Green River, Brougham, Whitevale and Greenwood) Rural Mail Route, from the Postmaster General's pleasure.

Printed notices containing further information as to conditions of proposed Contract may be seen and blank forms of Tender may be obtained at the Post Offices of Locust Hill, Green River, Brougham, Whitevale, Greenwood, and at the office of the Post Office Inspector, Toronto.

A. SUTHERLAND,

Post Office Inspector.

Post Office Inspector's Office,
Toronto, February 3rd, 1914.

6-7-8

Tenders Wanted

Sealed tenders will be received by the undersigned for lump sum or separate tenders for all trades required in the alterations and additions to the Registry Office for the County of Welland in the Town of Welland, up to 12 o'clock noon, Tuesday, March 3rd, 1914.

Plans and specifications may be seen at the office of the County Clerk, Welland, Ont.; office of A. E. Nicholson, architect, of St. Catharines, Ont., and the office of the Contract Record, Toronto, Ont.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of H. J. Knoll, Warden, or two personal sureties approved of by the Warden, equal to 10 per cent. of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The County does not bind itself to accept the lowest or any tender.

Tenders to be marked on envelope "Tender for Registry Office."

ROBERT COOPER, County Clerk,
Welland, Ont.

6-8

Wanted Employees

WANTED—Machinist, capable of taking charge of small shop. State experience and present salary. Box 953, Contract Record, Toronto. 5-6

WANTED—SALES AGENTS

A large Michigan firm manufacturing concrete mixers wants to secure reliable sales agents for Ontario, Quebec and Eastern Canada. A liberal proposition will be made to any firm having a good organization to cover the whole or part of this territory. Apply Box 959, Contract Record & Engineering Review, Toronto. 6-8

Representatives Wanted

The Industrial News Association, Cromwell Buildings, Manchester, Eng., invites communications from those open to represent U. K. manufacturers of engineering, contracting plant, and building materials and equipment. Full particulars are required as to territory covered and facilities for handling sound propositions. Credit and other references are required. 5-6-7

Wanted Employment

The advertiser is open to take position in connection with a woodworking plant, have had years of experience in high class interior wood finish, estimating, closing contracts, designing and detailing. Correspondence invited. Apply Box 954, Contract Record, Toronto. 5-6

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent., an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929 Contract Record, Toronto. 53-12

FOR SALE

One standard gauge locomotive in operating condition. Cylinders 24 in. x 18 in.

The Jenckes Machine Company, Ltd.,

6-19

Sherbrooke, Que.

Residences

(Continued from page 77)

biilding on Amelia St., for W. H. Mal-lory, 31 Queen W., tenders are being re-ceived on plumbing, heating, tile floors, plastering, painting and decorating, elec-tric wiring, iron work (ornamental and galvanized); tenders are in on masonry and carpentry.

Plans have been drawn for 1 pair and 3 detached residences on Ravina Cres., for T. Crouch & Co., 26 Rusholme Park Cres., who will sublet some trades.

S. A. Waggett, architect, 125 Isabella St., has drawn plans for a rooming house to be erected on Carlton St., at a cost of \$80,000, for W. E. Dyer, 160 Huron St.

Plans have been drawn for one pair residences, on Follis Ave., for R. B. Bur-kell, 186 Rusholme Road.

Plans have been drawn for 3 attached and 1 pair residences, on Victor Ave., to cost \$10,000, for J. A. Gallagher, 443 Broadview Ave.

Plans have been drawn for 1 pair resi-dences, on Browning Ave., for A. W. Betson, 3 Fenwick Ave.

Plans have been drawn for 2 pair resi-dences, on Alton St., for J. Kritzer, 101 Boston Ave.

Toronto, Ont. (York Mills)

Plans are being drawn by Gordon M. West, 2 College St., for a residence for Rev. C. A. Myers.

Vancouver, B.C.

A permit for 2 residences to cost \$12,-000, has been granted to Bentley & Wear, 2042 Granville street.

Victoria, B.C.

A permit for a residence, to cost \$10,-000, has been granted to H. J. Scott, 302 Douglas St. Architect, Thos. D. Sedger, 512 Bastion street.

Windsor, Ont.

J. C. Pennington, architect, will receive tenders from Feb. 12th until 19th, for double residence, to cost \$7,000.

Winnipeg, Man.

The Daykin Scott Constr. Co., 177 Hig-gins Ave., propose to erect an apartment block on Maryland St., at an estimated cost of \$90,000.

CONTRACTS AWARDED

Hamilton, Ont.

Additional contracts have been award-ed in connection with the residence on Aberdeen, for Walter Parke. Archi-tects, McPhie, Kelly & Darling, Bank of Hamilton Bldg.; tinsmith, Chas. Drew, 171 King William St.; plastering, Hanna-ford Bros., 232 Robinson St.; painting, W. J. Robinson, 33 Erie Ave.; heating and plumbing, W. J. Walsh, 203 King E.; electrical, Electric Supply Co., 65 James St.; sewer, J. J. Armstrong, 138 Erie Ave.

The following contracts have been awarded on 18 residences being erected on Avalon Place by MacKay Bros. Lister Chambers, James St.; plastering J. Moores, 170 Cumberland; painting, J. Scott, 439 Charlton W.; plumbing, J. E. Gibson, 676 King E.

The following contracts have been awarded on Barnesdale Ave. by Jas. Bryers, Wilson & Gibson Ave. Mason, John Bryers, 724 Carmon E.; plastering, T. Squires, 165 St. Clair; painting, Geo.

H. Thornevell, 44 Highland; heating & plumbing, Jas. Saynor, 173 John St. S.

Montreal, Que.

The following sub-contracts have been awarded in connection with the flats on Marcil St., for H. J. Gagne, 97 St. James St. Plastering, J. O. Nantel, 88 Old Orchard St.; heating, Can. Rector Gas Heating Co., Hamilton, Ont.; plumbing, J. St. Armand, 109 Laurier St. W.; elec-trical, Can. Illuminating Co., New Birks Bldg.

Montreal, Que. (Westmount)

The following contracts have beer awarded in connection with the resi-dence on Sherbrooke St., for A. Dionne. Stone, A. Charette, 1121 St. Antoine; brick, S. Rochon, 1891 Esplanade; the other contracts to be awarded shortly.

The contract for plastering the resi-dence of J. E. Dalrymple, on Carleton St., has been awarded to Watson & Wat-son, 1680 Hutchison St.

Ottawa, Ont.

The contract for electrical fittings at the residence of J. W. Nelson, 130 3rd Ave., has been awarded to E. G. Tressid-der, 58 5th Ave.

The contract for electrical fittings at the residence and garage of W. E. Noffke, on Clemow St., has been awarded to W. R. McCallum, 498 Gladstone St.

The contracts for the erection of 14 residences on Sussex St., for A. L. Flor-ence, have been awarded to general con-tractor, A. C. Burton, 509 McLeod, car-pentry, McAuliffe Davis Co., Duke St.

Qualicum, B.C.

The contract for the erection of the bungalow planned by Spurgin & Wilkins, 405 Times Bldg., Victoria, has been awarded to Tinney & Humphries, 429 Pender St. W., Vancouver.

Power Plants, Electricity and Telephones

Buckingham, Que.

The municipal council has under con-sideration the installation of an electric lighting system.

Hamilton, Ont.

Tenders addressed to W. J. Ellis, City Hall, will be received until Feb. 13th, for 4,560 electric meters. Specifications at office of engineer, E. J. Sifton, City Hall.

Listowel, Ont.

The installation of a hydro system is being considered by the town council.

Medicine Hat, Alta.

The city council included in their esti-mates the sums of \$10,000 for electrical distributing system, and \$20,000 for street lighting purposes.

Montreal, Que. (Outremont)

Tenders will be received by E. T. Sampson, Town Hall, sec.-treas., until 6 p.m. Feb. 18th, for supply and delivery at the Corporation Yard, Outremont, of the following: approximately 87,000 ft. No. 8 B & S single armored cable; ap-prox. 21,000 ft. No. 8 B & S duplex arm-ored cable; approx. 9,000 ft. No. 8 B & S duplex lead sheathed cable. Cables to be for 6,500 volt, working voltage. Price to be given per foot, including de-livery. Also add price per joint for

splicing. Cables to be delivered within 10 weeks from placing of order.

Ottawa, Ont.

Tenders are called for re-lighting 4th Ave. Baptist Church with tungsten lamps. Pastor, Rev., C. R. Duncan, 21 Wilton Cres.

The Ottawa Electric Railway Company has decided not to call tenders for steel rails. Information will be received by Supt. Burpee.

Williamsburg, Ont.

The village has been offered power by the Hydro-electric Power Commission of Ontario; transformer station to be erect-ed at Morrisburg. The ratepayers will vote on the question shortly.

Winnipeg, Man., (May St.)

The Board of Control has been in-structed to call for tenders for extension to power station to provide for additional street lighting. Estimated cost \$18,000.

CONTRACTS AWARDED

Hamilton, Ont.

A contract has been awarded by the City Council (Hydro-electric Dept.) to the Standard Underground Wire & Cable Co., Sherman Ave., for the supply of 60,-000 lbs. wire, at 18c. per lb.

Lacombe, Alta.

A contract has been awarded by the town council to the Canadian General Electric Co., Ltd., Winnipeg and Calgary, for 100 kw. 2300 volt engine. Type, 3-phase, 60-cycle generator, 277 r.p.m., with belted exciter.

Miscellaneous

Bruce Twp., Ont.

The Twp. Council will shortly call ten-ders for the supply of 50 lengths 30 in. tile; 50 lengths 24 in. tile; 100 lengths 18 in. tile; 75 lengths 12 in. tile; 50 lengths 10 in. tile; 50 lengths 8 in. tile.

The Twp. Council will shortly call ten-ders for the supply of 75 16-ft. posts; 100 10-ft. posts; 25 12-ft. posts; 75 8-ft. posts; 5,000 ft. covering 16 ft. long and 5 in. thick.

Calgary, Alta.

The City Commrs. will receive tenders until Feb. 18th for the supply of tools and machinery. Specifications from City Engineer or storekeeper. Clerk, J. M. Miller.

Canboro Twp., Ont.

Tenders will be received by Reeve, J. A. Sorge, until Feb. 14th, for the supply of 1,000 ft. white oak plank, 14 ft. long x 2½ in. thick.

Edmonton, Alta.

The city council has under considera-tion the purchase of fire apparatus to the value of \$50,000. Fire Chief, Mr. Lauder.

Elderslie Twp., Ont.

Tenders will be received by R. C. Pearce, Paisley, Clerk to the Township Council, until Feb. 2nd, for the supply of 15,000 ft. first class cedar, 16 ft. long, 4 in. thick, 6,500 ft. to be delivered at Lock-erby Bridge by May 1st.

Hamilton, Ont.

The following have been provided for in the city estimates for 1914. Motor

(Continued on page 82)

“Inglis” Corliss Engines

are known above all others as being pre-eminently “Engines of Quality,” Economical, Durable and Reliable and can be depended upon to give the same good results twenty years from now.

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tractor truck No. 2, \$7,600; motor tractor steamer No. 2, \$7,600; aerial hook and ladder truck, \$5,750; hook and ladder truck, \$3,775; steam fire engine, \$5,500; 50, 45, 35 ft. extension ladders, \$250; 10 new fire alarm boxes, \$1,000.

The city council will be open to receive tenders from Feb. 1st for about 10 days for the year's supply of hydrants and extension boxes, valves, iron pipe and special castings, lead pipe, pig lead, sewer pipe, traps, bends, etc., road oil, asphalt, Portland cement, lime, gravel, lumber, creosote wooden blocks, paving blocks, sewer bricks. Further information from Engineer, A. F. Macallum, or Sec., W. C. Brennan.

The City Council (Hydro-electric Dept.) will receive tenders until Feb. 1st for the supply of 60,000 lbs. copper wire, various sizes.

London, Ont.

The city council is considering the purchase of a fire escape for the City Hall, 3 storeys high.

Montreal, Que.

Fire Chief J. Tremblay, has asked the Board of Control for 5,000 ft. fire hose and 200 salvage covers, and tenders will be called if the proposition is accepted.

Montreal, Que. (St. Laurent)

R. H. Miner Co., Ltd., Coristine Bldg., Montreal. Owner will receive tenders for 4 or 6 concrete partition tile presses for different sized blocks, 1 concrete mixer to look after 12 machines, 1 agitator, 1 boiler 100 h.p., 1 electric motor about 50 h.p.

North Vancouver, B.C.

Fire Chief Findlay recommends the purchase of motor chemical and motor hose truck, also installation of 30 additional fire alarm boxes.

Ottawa, Ont.

The city council will shortly call tenders for the supply of lead and sand for 1914.

Separate tenders will be received by Chairman, Board of Control until 4 p.m. Feb. 24th, for the supply of cement, brick, lumber, sand, and brass goods and castings. Specifications at offices of City Engineer and MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Regina, Sask.

The City Council has accepted proposal of Messrs. Coste & McAuley of Calgary, to supply gas at city limits, and a by-law will be voted on by the rate-payers confirming acceptance.

Sudbury, Ont.

The town council will purchase 1,000 feet of fire hose.

Wm. H. Owens, architect, wishes catalogues and samples of all kinds of building materials.

Toronto, Ont.

The Board of Control has recommended the awarding of the contract for the year's supply of timber to Reid & Co., Berkeley St.

The Pittsburgh Valve, Foundry & Construction Company, of Pittsburgh, Pa., completed and shipped the first of an order of 4 72-in. gate valves for the city of Toronto (Roger Miller & Sons, Ltd., contractors) on January 27th, four weeks after the receipt of the order and

one week before the scheduled day of delivery. The construction of the remaining three valves on this order is progressing and their completion will also probably anticipate scheduled delivery.

The Board of Education estimate of \$5,750 for Department of Physics and Shopwork includes vises, hardware, motors, engine, lathe, drills, presses, tools, trimmer, etc. Dept. of Architecture Machine Drawing & Design, \$3,800, includes: drawing boards, tee squares, drafting outfits, blue print machine. Dept. of Mathematics, \$700, astronomical telescope, sextant, transit, etc. Sec., W. C. Wilkinson.

Tenders will be received by W. C. Wilkinson, Sec.-Treas. Board of Education, until noon, Jan. 30, for the supply of Prism floor lights, cabinet work, hoists for ashes, plumbing work, white lead, oil and turpentine, Kindergarten tables and chairs. Specifications and further information from Supt. of Bldgs., City Hall.

South Vancouver, B.C.

The sum of \$21,000 was included in the estimates for 1914 for providing the schools with manual training equipment.

Victoria, B.C.

Purchasing Agent, W. Galt, will receive tenders until 3 p.m. Feb. 13th, for 3,000 ft., 2½ in. cotton rubber lined fire hose with couplings and expansion rings.

Wallace Twp., Ont.

Tenders will be received by the Clerk, D. Greer, Gowanstown, or the Reeve, S. E. Smith, R.R. No. 1, Listowel, until February 14th, for the manufacture of concrete tile, 8-in., 12-in., 18-in. and 24-in., to be delivered on the premises of each Road Commissioner, in each division.

Winnipeg, Man.

Tenders will be received by Board of Control until Feb. 17th for 1,500,000 to 2,000,000 feet B.M. lumber.

CONTRACTS AWARDED

Cobalt, Ont.

The contract has just been awarded for the supply of centrifugal pumps for draining the Cobalt Lake, and the Turbine Equipment Co., Ltd., Toronto, have been successful in securing the order for the following motor driven pumps: 3 De Laval single stage, double suction, centrifugal pumps, each having a capacity of 3,500 gallons a minute against 100 ft. head, and two 3-stage pumps, each having a capacity of 600 gallons a minute against 360 ft. head. All these pumps will be equipped with Manganese Bronze impellers, as there will be a very large amount of grit in the water.

New Companies

Grenville Development Co., Ltd., has been incorporated with a capital of \$100,000, with head office at Vancouver, B.C., to carry on business as a power company.

Grain Growers Lumber Co., Ltd., has been incorporated with a capital of \$10,000, with head office at Vancouver, B.C., to carry on business as lumber merchants.

La Compagnie Electrique de Saint Polycarpe, Limitee, has been incorporated with a capital of \$20,000, with head office at Coteau Landing, Que., to carry on business as electrical engineers. The

provisional directors are J. A. Bourdeau, Montreal; J. Aumais, and A. Jeannotte, Coteau Landing; C. Jasmin, Coteau Junction, and J. A. Gareau, St. Polycarpe, Que.

General Electric Contracting Company, Ltd., has been incorporated with a capital of \$10,000, with head office at Vancouver, B.C., to carry on business as electrical contractors.

Peace River Properties, Limited, has been incorporated with a capital of \$10,000, with head office at Vancouver, B.C., to carry on business as a land and building company.

Willow River Lumber Co., Ltd., has been incorporated with a capital of \$50,000, with head office at Vancouver, B.C., to carry on business as lumber merchants.

La Compagnie Industrielle de Vaudreuil, Limitee, has been incorporated with a capital of \$49,000, with head office at Vaudreuil, Que., to carry on business as sash and door manufacturers. The provisional directors are J. A. Bourdeau, Montreal; A. R. Lefebvre, A. Castonguay, H. Becotte and J. A. Legault, all of Vaudreuil, Que.

The Saint Johns Machinery and Tools Co., Ltd., has been incorporated with a capital of \$45,000, with head office at St. Johns, Que., to carry on business as tools manufacturers and general contractors.

(Continued on page 84)

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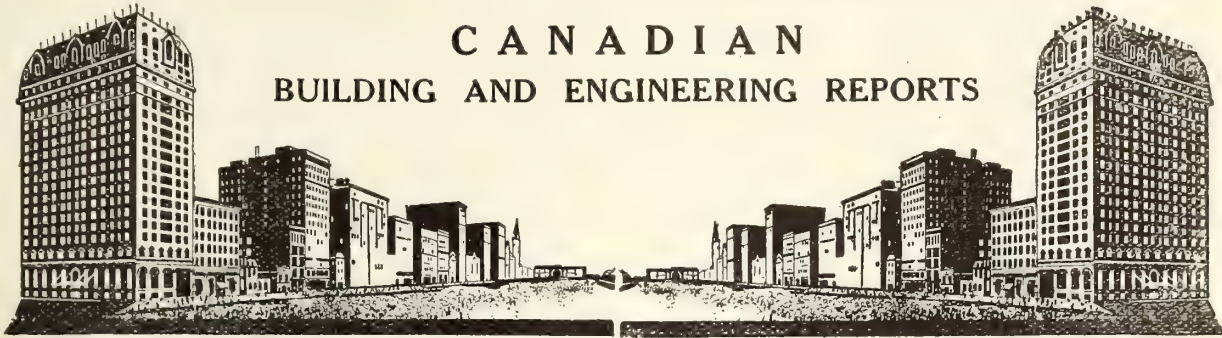
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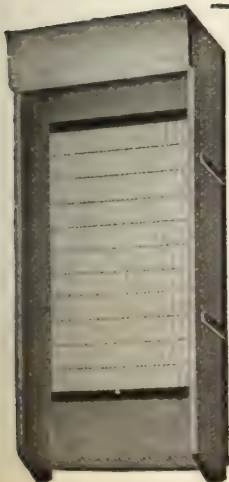
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tors. The provisional directors are O. Bard, E. Patenaude, J. B. Demers, A. N. Deland, and A. Boutheillier, all of Saint Johns, Que.

The Ross Church Road Company, Ltd., has been incorporated with a capital of \$75,000, with head office at Montreal, to carry on business as road contractors. The provisional directors are E. S. McDougall, F. G. Bush and G. R. Drennan, all of Montreal.

Keystone Electric Co., Ltd., has been incorporated with a capital of \$49,000, with head office at Montreal, to carry on business as electrical engineers. The provisional directors are H. A. Burbidge, J. R. Marshall and P. J. Knox, all of Montreal.

Scheifele and Fischer, Ltd., has been incorporated with a capital of \$40,000, with head office at Waterloo, Ont., to carry on business as builders merchants. The provisional directors are O. G. Scheifele, C. E. Fischer, Waterloo, and H. Hass, Berlin.

The Ante-fired Clay Products Co., Ltd., has been incorporated with a capital of \$250,000, with head office at London, Ont. The provisional directors are J. W. McCallum, E. Wright, G. S. Wright, C. S. Parker and L. E. Tillson, all of London, Ont.

Custodis Canadian Chimney Co., Ltd., has been incorporated with a capital of \$40,000, with head office at Toronto, to carry on business as general contractors. The provisional directors are G. Ruel, R. H. M. Temple and G. N. Limpricht, all of Toronto.

Marbles and Tiles, Limited, has been

incorporated with a capital of \$32,000, with head office at Toronto, to carry on business as marble merchants. The provisional directors are J. M. Duff and F. Logan.

The Buff Pressed Brick Company of Hamilton, Ltd., has been incorporated with a capital of \$40,000, with head office at Hamilton, Ont., to carry on business as brick manufacturers. The provisional directors are J. R. Roberts, S. H. Slater and A. Inch.

Thomson-MacDougall Co., Ltd., has been incorporated with a capital of \$250,000, with head office at Winnipeg, to acquire the business of Thomson-MacDougall Company, and carry on business as sand, gravel and cement merchants, etc. The provisional directors are T. T. Thomson, H. MacDougall, C. H. Booth and A. H. Warner, all of Winnipeg.

Coast Range Cedar Shingles and Lumber, Ltd., has been incorporated with a capital of \$10,000, with head office at Vancouver, B.C., to carry on business as lumber manufacturers.

Business Notes

Galt, Ont.

The plant of Messrs. Shurley & Dietrich Co., Glebe St. (saw manufacturers), was recently destroyed by fire. Loss, \$200,000. Insurance, \$65,000.

Granby, Que.

The Granby Steam Laundry premises have been partly destroyed by fire; loss is covered by insurance.

Luseland, Sask.

A large business block has been des-

troyed by fire and the following sustained losses as specified: Mr. Salzbrun, general store, loss \$3,000; Boulton's Bakery, loss \$1,600, insurance \$1,200; Luseland Pharmacy, loss \$4,000, insurance \$3,000; Watson & Howard, general store, loss \$20,000, insurance \$13,000; post office, loss \$1,000; Luseland Despatch, loss \$500, insured.

Montreal, Que.

The Deaf & Dumb Institute has been damaged by fire. Loss \$20,000.

The warehouse and factory of the Merchants Clothing Co., 36 West Notre Dame St., together with all the machinery has been destroyed by fire. The loss is estimated at \$200,000.

The C. P. R. grain elevator on King Edward Pier, including about 60 conveyors, has been badly damaged by fire.

The firm of D. G. Loomis & Son, contractors, has been registered.

The partnership of Lacroix and Pelletier, contractors, has been dissolved.

Ottawa, Ont.

Four residences on 5th Ave., owned by C. Rupert, 37 5th Ave., were destroyed by fire. The property was insured and will be rebuilt.

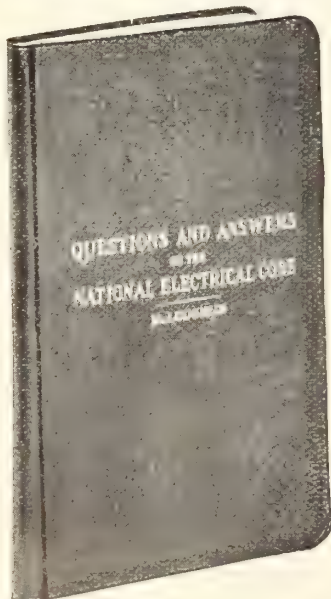
Rigaud, Que.

The firm of Levac, Charette & Co., has been registered as contractors, the partners are J. O. Levac and J. G. Charette.

St. John, N.B.

The factory of Mark Fisher, Sons & Co. has been destroyed by fire. Loss to building \$25,000, was covered by insurance.

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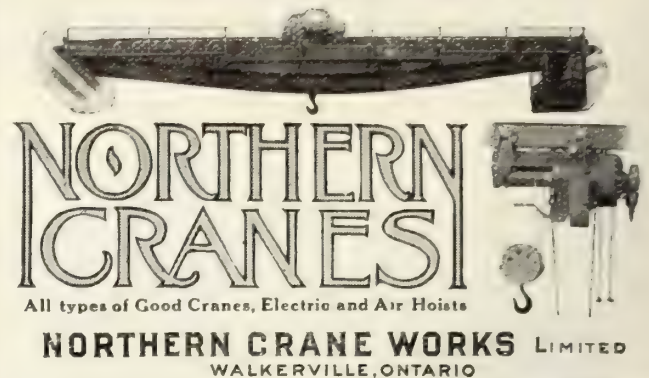
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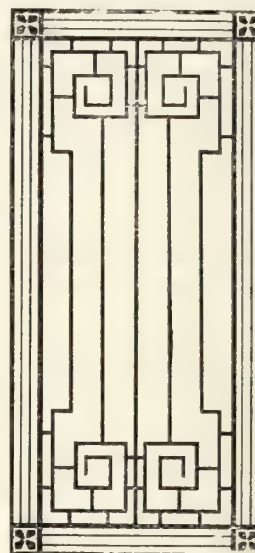
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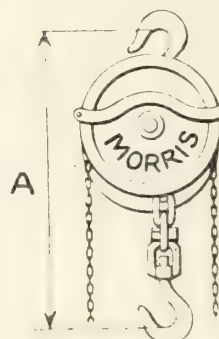
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 - 1—30-in. Boston Cupola and forge blower.
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 - 1—Set Car Irons, 24-in. chilled wheels, 3½-in. axles, 36-in. gauge. Babbitted bearings outside wheels.
 - 1—Vertical Boiler, 33-in. x 84-in. new mountings and short stack.
 - 1—Vertical Boiler, 37-in. x 90-in., new mountings and short stack.
 - 3—Vertical Boilers (new), 30-in. x 72-in., mountings and short stack.
 - 1—Rand Air Hoist Class "B" 4-in. x 4-ft. lift.
 - 1—Steel Ore Bucket, straight sides, 37 x 37, ring and pin fastening (new).
 - 1—Steel Ore Bucket, taper sides, 8 cu. ft., ring and pin fastening (new).
 - 1—6-ply Monarch Rubber Belt, 20-in. x 6-ft.
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F. G. Fowler, Const. Co., Mt. Kisco, N.Y.
Brown & Lowe, Schenectady, N.Y.
Buckley Const. Co., Plattsburg, N.Y.
Newport Const. Co., Newport, N.Y.
Monroe Roads Co., Pittsford, N.Y.
Santanoni Const. Co., Newcomb, N.Y.
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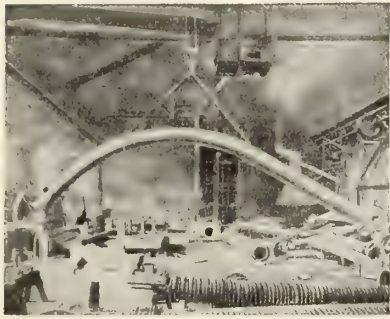
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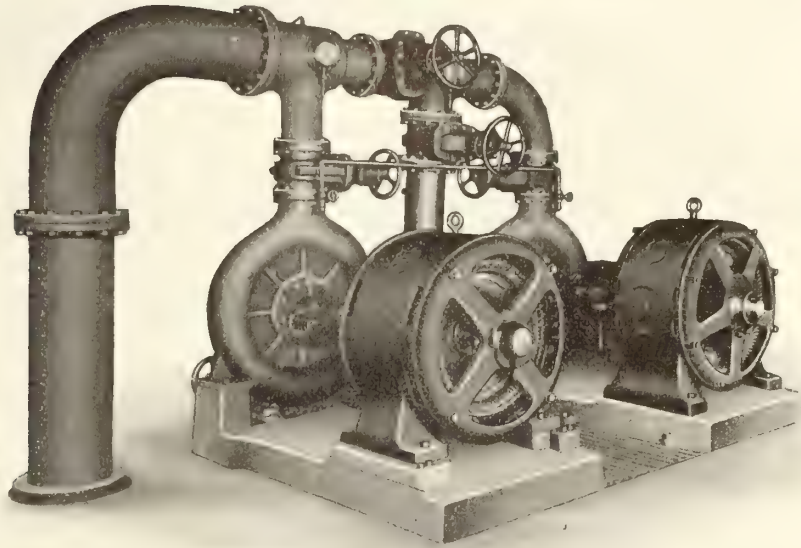
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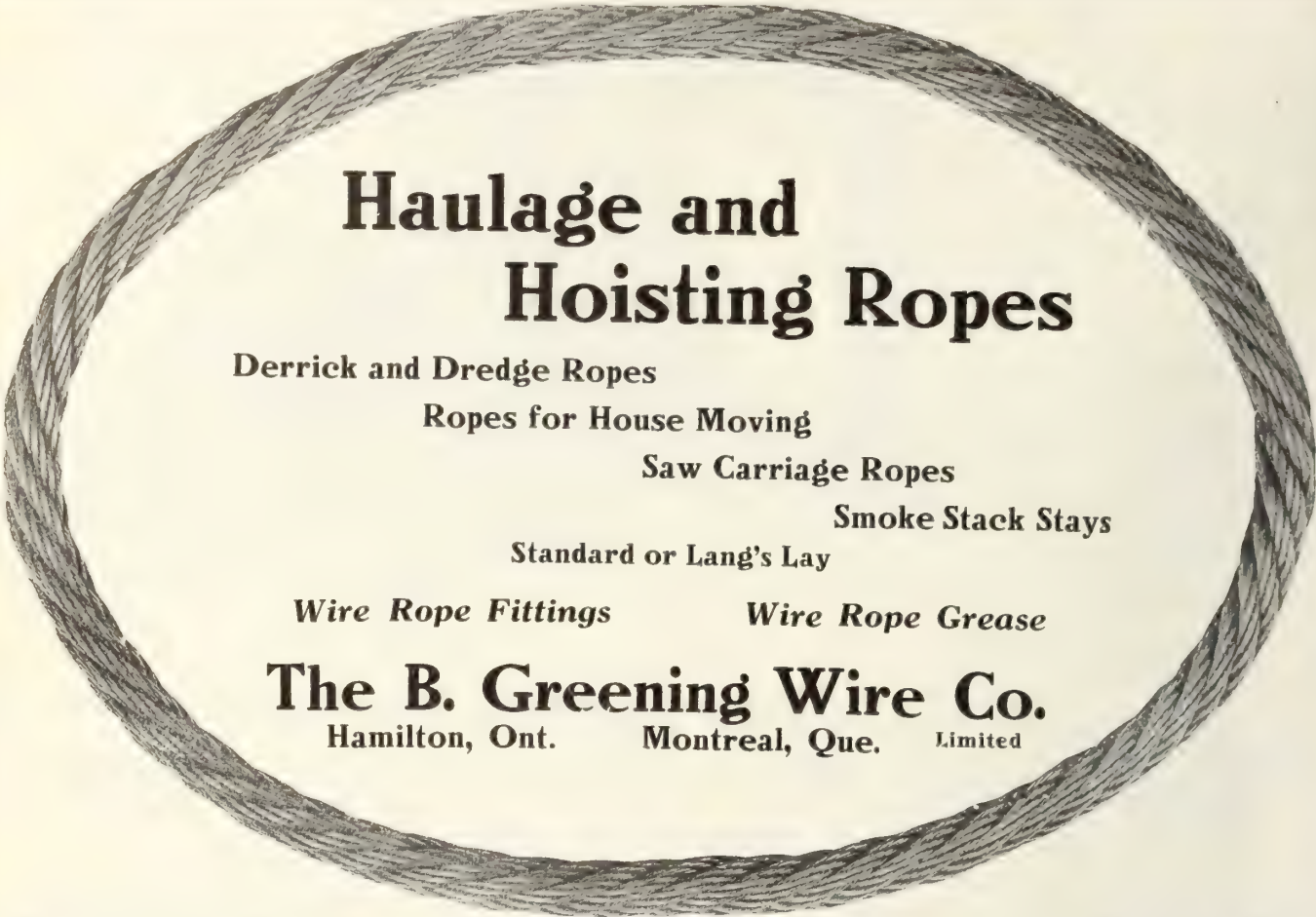
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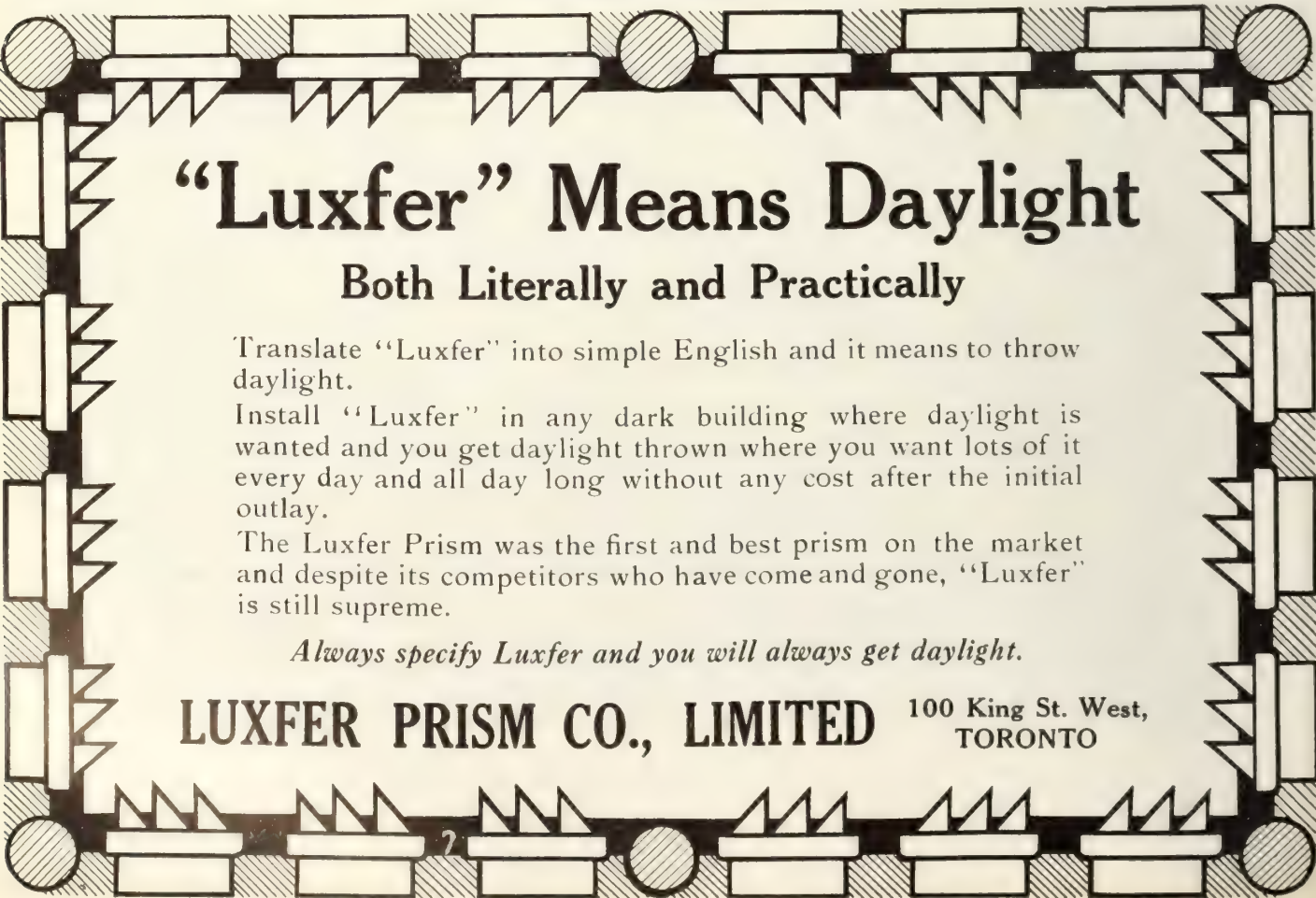
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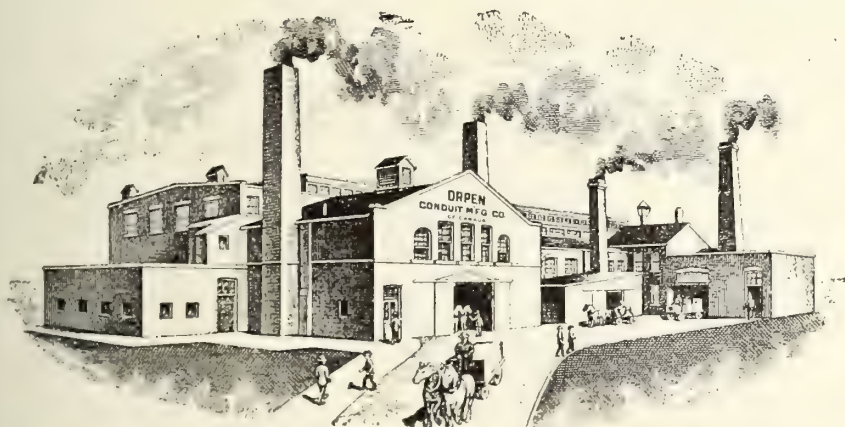
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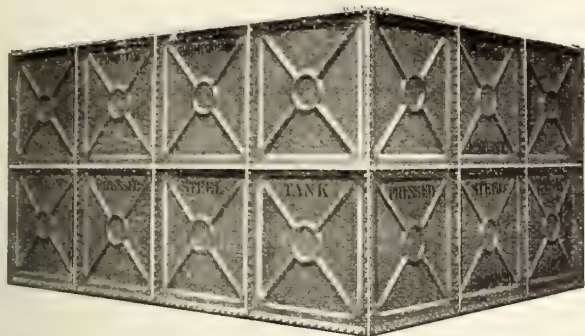
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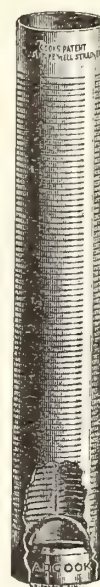
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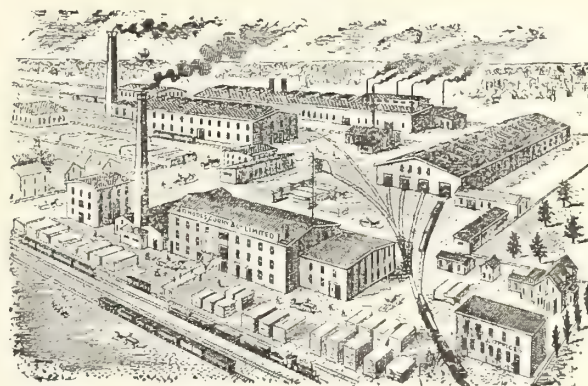
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and
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were
4500
Con-
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Number of Other Workmen Injured—
Chain Holding 800-gallon
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(By Associated Press)

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MANSFIELD, Eng. Feb. 8—Thir-
teen pit sinkers were killed and a
number of others injured today at
the Bols over colliery by the snapping
of a chain to which was suspended
a bucket containing 800 gallons of
water.

The bucket crashed down the shaft,
which was 500 feet deep and at the
bottom of which the men were work-
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an unrecognizable mass. Only a few
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at the sides of the shaft escaped
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This city is the center of a large
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covers large area. No frost troubles.
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Put up in bags ready for immediate
use by mixing with water only.

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How About the "Heart Action" of Your Drills?

The valve is the
Every function of
depends upon the



"heart" of a rock drill.
the drill, as a drill, de-
character of its valve.

The valve determines the economy (or otherwise) of air or steam; the character of the blow; the speed of drilling. **In fact the valve action makes or mars the operation of the drill.**

Consider the "Butterfly" valve. Note first of all its simplicity, as pictured here—two sturdy wings on a centre body—all of toughest steel. Can you conceive of anything more simple—stronger—less liable to get out of order.

The ports are not opened or closed by a sliding movement, but by a movement like opening a book. Can you imagine an arrangement with less opportunity for wear?

The very slight "lift" of the valve from its seat gives an enormous port opening—**actually larger than the area of the ports themselves.** No chance here for "wire drawing" or back pressure, or slow, sluggish movement.

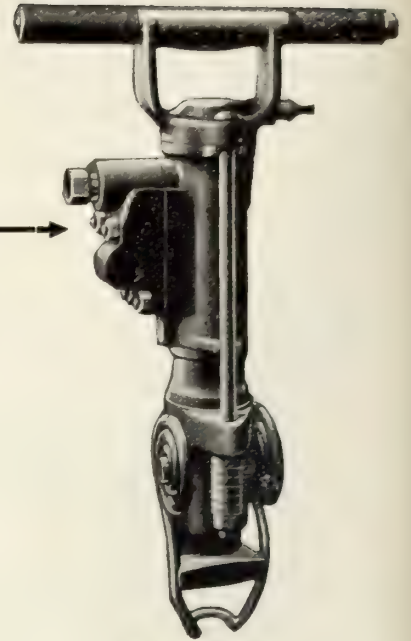
This "feather-weight" valve is moved by slight differences of pressure on two of its broad faces. And because it is so light **the movement of the valve is instantaneous**; while the impact on seating is so small as to be in no way injurious.

Here you have an oil-toughened, heat-treated valve of tremendous strength, working in a valve chest of simple construction with large unrestricted ports.

Because there is no wear to valve or seats—because the seating is complete and positive—there can be no leakage and waste of air or steam.

When you have fully grasped the distinctive features of this "Butterfly" valve, you'll understand why the "Jackhammer" and "Butterfly" Stoppers and Plug Drills (all using the "Butterfly" valve) hit harder, drill faster, do more work per unit of power used, than any other drills you can buy.

And these are the very qualities you want in your drill—aren't they?



The Jackhammer
used extensively for
sinking and down holes
of moderate depth.

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Works: SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

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We call it the "RED" Catalog. That is because we make only **red** brick and this catalog is printed in colors—the illustrations of the bricks and the buildings showing the **real red** of the brick.

The RED is unusual. It is due to the red shale of which these bricks are made. You will like it. Your clients will like it. It is a warm, rich—sort of an "aristocratic" red. And it is beautiful.

So we want you to send for this catalog—today. We want you to know

"BRADFORD PRESSED BRICK"

(Trade Mark Reg. U.S. Pat. Office)

THE STANDARD RED BRICK OF AMERICA. We want you to specify and use it.

Other brick will do for many jobs—but for better class houses, school buildings, churches, business buildings and hospitals—where you want something distinctive — THEN use "BRADFORD REDS"—the smooth brick—or "Bradford Ruffs"—the rough textured brick.

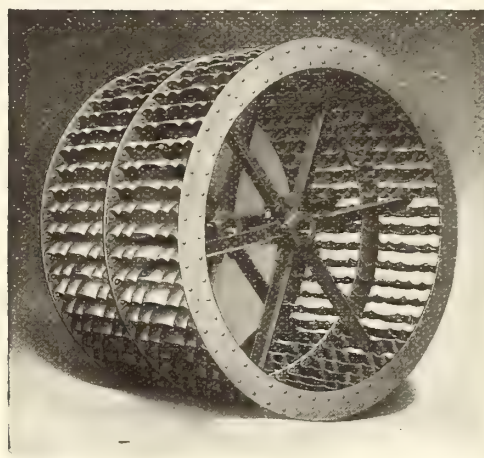
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"The Red Brick People"
Bradford, Pa.

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Galt, Ontario

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919 New Birks Building, Montreal

Current Prices of Building and Engineering Materials

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	\$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Brick	13 00
Grey Stock Brick	12 00
Wire cut brick for foundation work	11 00
Porous terra cotta brick	15 00
No. 1 enamelled brick, all colors, from	\$80 00 to \$150 00
Sand-Lime Brick (King Edward Siding)	8 10

LUMBER (Building Material)

Hemlock Lumber—	
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	\$26 00
2 x 4 to 2 x 12, 16 ft.	26 00
2 x 4 to 2 x 12, 18 ft.	29 00
1 in. Hemlock, No. 1	25 00
No. 1 Hemlock Decking	25 00
No. 2 Hemlock dimension and 1-in.	19 00

Pine—	
1 in. common pine 8 to 12 in. wide rough	26 00
2 in. white pine Bill stock	29 00
2 x 8 and 10 in. pine shelving	36 00
2 x 12 in. pine shelving	45 00
No. 1 white pine flooring	33 00
No. 1 spruce flooring	28 00
No. 1 pine decking D2S	30 00
Spruce Decking	28 00
No. 1 pine V. or headed sheeting	36 00
No. 2 pine V. or beaded sheeting	32 00

Pine trim for paint finish—	
4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8-in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—	
XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—	
5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:	
8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x18, 16x18	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

	Star	D.D.
25	\$3 25	\$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	\$3 50	\$5 00
26/40	3 75	5 50
41/60	4 25	6 25
51/80	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 65 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 70 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net\$1.85
No. 4½ Fuller's net\$2.35
Square head brass cocks, 65 and 5 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6¼ cents per lb.; traps and bends, 40 per cent.; pig lead, 6¼ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black	Galvanized
¼ inch	\$2.16	¼ inch \$3.06
½ "	2.16	½ " 3.06
¾ "	2.64	¾ " 3.57
1 "	3.05	1 " 4.20
1 ¼ "	4.51	1 ¼ " 6.21

1¼ "	6.10	1½ "	8.40
1½ "	7.29	2 "	10.04
2 "	9.81	2 ½ "	13.51
2½ "	16.80	3 "	21.65
3 "	20.68		28.31

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 and 10 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in. 25c ft.	15-in. 1.40 ft.
6-in. 40c ft.	18-in. 1.90 ft.
9-in. 70c ft.	20-in. 2.25 ft.
12-in. 1.00 ft.	24-in. 3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.
Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.
Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; ¾-inch, \$1.45.
Burnt River rubble stone delivered, \$16 to \$17 per ton.
Plain steel bars, \$2.25.
Square twisted bars, ¾ to 1¼, \$2.35.
Malleable fittings — Canadian discount, 45 and 42½ per cent.
Free stone delivered, \$15 to \$18 per ton.
Brown coursing stone, delivered, \$3.75 per yard.
Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.
Sand, for cement or brick work, \$1.20 a cubic yard, f.o.b. Toronto, C. P. R. siding.
Sand, for cement or brick work, 85c to \$1.00 a cubic yard, f.o.b. Toronto, G. T. R. sidings.
Brown sills and heads, in the rough, delivered, 40 cents per foot.
Rubble stone in car lots, \$1.30 per ton.
Steel channels and beams, angles and plates, \$2.55 to \$2.90 per 100 pounds, delivered f.o.b. Toronto.
Hard Wall Plaster, unsanded, from \$8.00 to \$8.50, bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.
Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.
Plaster of Paris, Anchor and Crown Brands, \$1.50 bbl.
Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, \$8.75 per 100 lbs.
Boiled Linseed Oil in bbls., 65c per gal. of 9 lbs.
Raw Linseed Oil, in bbls., 62c per gallon.
Pure Red Lead, dry, \$7.00 to \$8.00 per 100 lbs.
Putty, pure linseed oil, in bulk, bbls., 3¼c.
Putty, pure linseed oil, in 25-lb. tins, 4c.
Turpentine in bbls., 66c.

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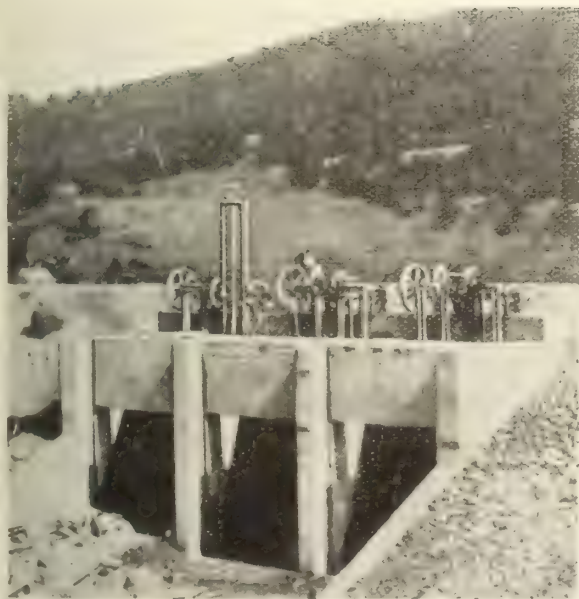
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GRAVEL is easier on your mixers.

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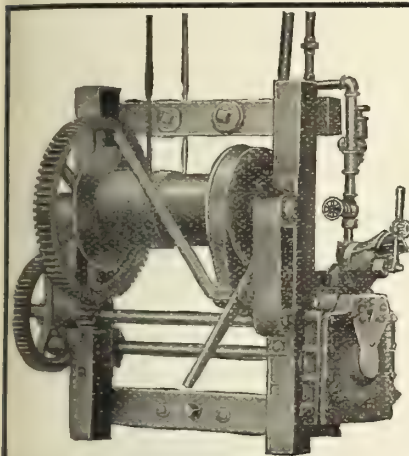
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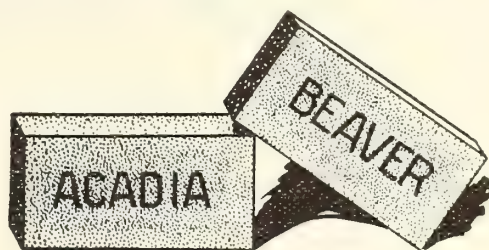
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These bricks are uniform in size, quality and appearance.

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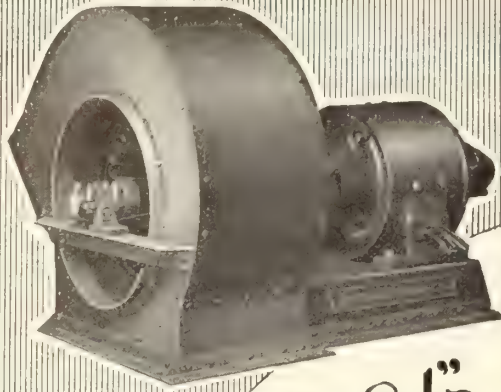
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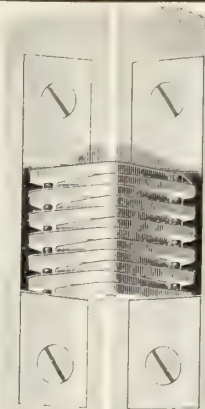
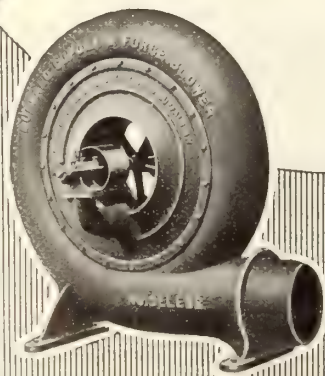
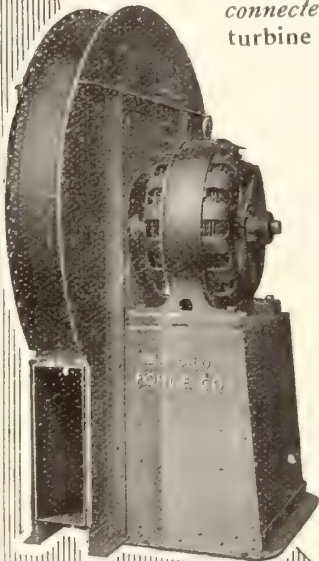
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**"A MOST INGENIOUS
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USEFUL DEVICE"**

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**For
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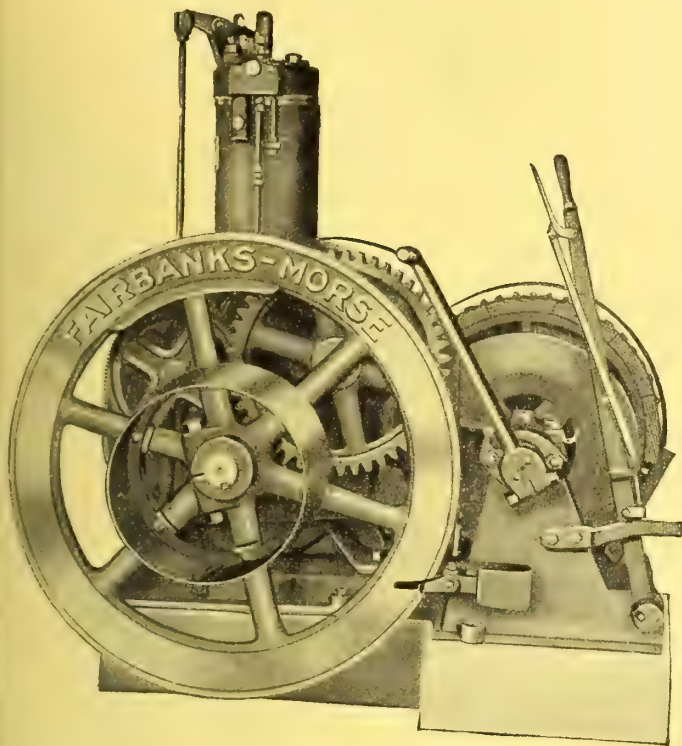
Established 1855

TORONTO

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Vertical Geared Hoisting Engine



The Fairbanks-Morse Type "T" Vertical Geared Hoisting Engine shown here is one of the most economical, durable and efficient hoists on the market. This is a 6 h.p., but they are made in sizes from 2 to 12 h.p. They are regularly fitted for gasoline, benzine or naphtha, but can be furnished to operate on oil or alcohol.

The drum runs loose on the shaft, while the large gear is keyed fast. A friction clutch mechanism, with conical surfaces, is mounted on the drum, which enables the load to be handled quickly and positively by means of a hand lever. The gearing connecting engine to the hoist drum can be thrown out of mesh, when it is desired to use the engine for other purposes.

Always Satisfactory for

Contractors	Ice Handling
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1



Across Canada with the

Imperial Wire & Cable Company, Limited

Toronto MONTREAL Winnipeg

First of a series of advertisements showing buildings of national importance which have been wired with Imperial Wire and Cable Co's. Limited, wires.

This picture shows the

The Ritz-Carlton Hotel, Montreal

Architects—Warren & Wetmore—New York.

Engineers—Mailloux & Knox—New York.

Electrical Contractors—J. Livingston & Co.—New York.

This hotel was wired with "Imperial" Higrade Rubber Insulated Wire.

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Gasoline Locomotive handling Steel Dump Cars

Locomotives

Steam and Gasoline

Suitable For

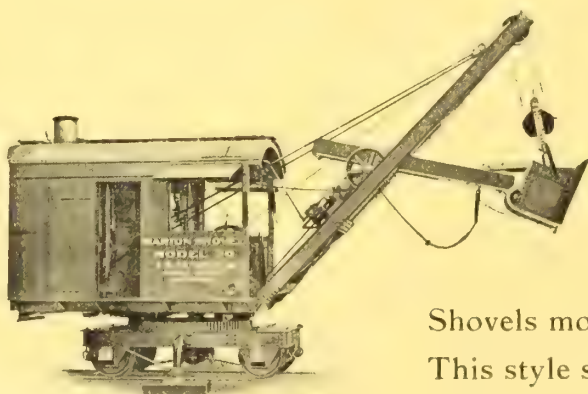
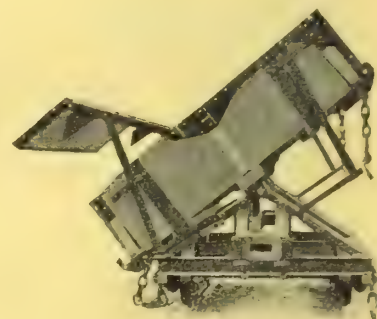
Brickyards, Quarries,
Mines, Contractors, etc.

All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.



“MARION” STEAM SHOVELS

Revolving Type

This type shovel is supplied in three sizes
58 - 1 and 1 1/2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks.
This style shovel is specially adapted for Brickyards—Mines
—Quarries, etc. Full details sent upon request.

F. H. Hopkins & Co.

MONTREAL

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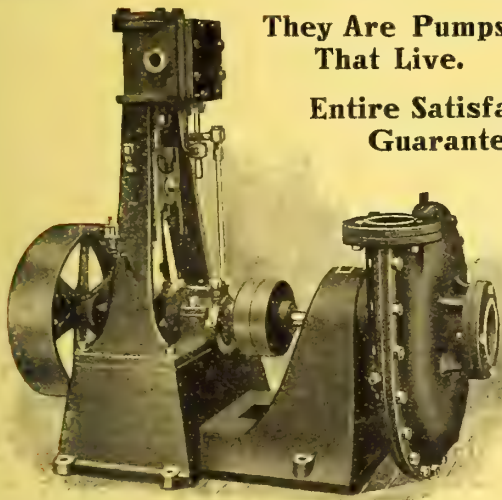
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Contract Record

ESTABLISHED 1886

and Engineering Review

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**They Are Pumps
That Live.**

**Entire Satisfaction
Guaranteed.**

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HAMILTON, CANADA

"MADE IN CANADA"

Bent Glass

**Made in all
Kinds of
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on Short
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**Large Bent Plate Glass for Shop
Fronts a Specialty**

**The Toronto Plate Glass Importing
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(HILL & RUTHERFORD, Managing Directors)

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THE "JACKHAMER"

is self-rotating,
self-lubricating
and it is an all-
steel drill oper-
ated by steam
or air.

A "One-Man Drill"

which will make
a decided re-
duction in your
drilling costs.
The drill you
are looking for.



*A Copy of K-68 will
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us for it.*

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Continuous and Machine Banded Wood Stave

WATER PIPE

RESERVOIR TANKS

for city and town Water Systems,
Fire Protection, Power Plants,
Hydraulic Mining, Irrigation, etc.
One-half the cost of Iron Pipe—
and better.

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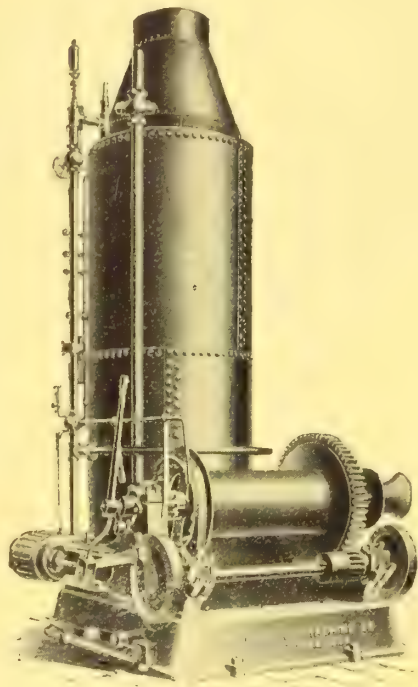
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Full Particulars and Estimates Furnished



Hoisting Engines

¶ To the Contractor who wants a good reliable and efficient hoisting engine,—one that will always be right on the job—we suggest an inquiry into our wide range of this type of machine.

Any one of our offices will help you find the engine best suited to your needs.

The JENCKES MACHINE COMPANY, Limited
General Offices: SHERBROOKE, QUE.

Works: Sherbrooke, Que.

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“American” Quadruple Block Lifting a 38 Ton Girder

A typical example of the every day service of “AMERICAN” Blocks is shown in the accompanying illustration.

The 38 ton girder being lifted so easily and safely by “AMERICAN” Blocks is now part of the steel work of the magnificent new Royal Alexandra Hotel in Winnipeg.

“AMERICAN” Blocks are built to give perfect service under severest conditions. All pins, axles, plates and straps are heavier than those of any other block of corresponding size.

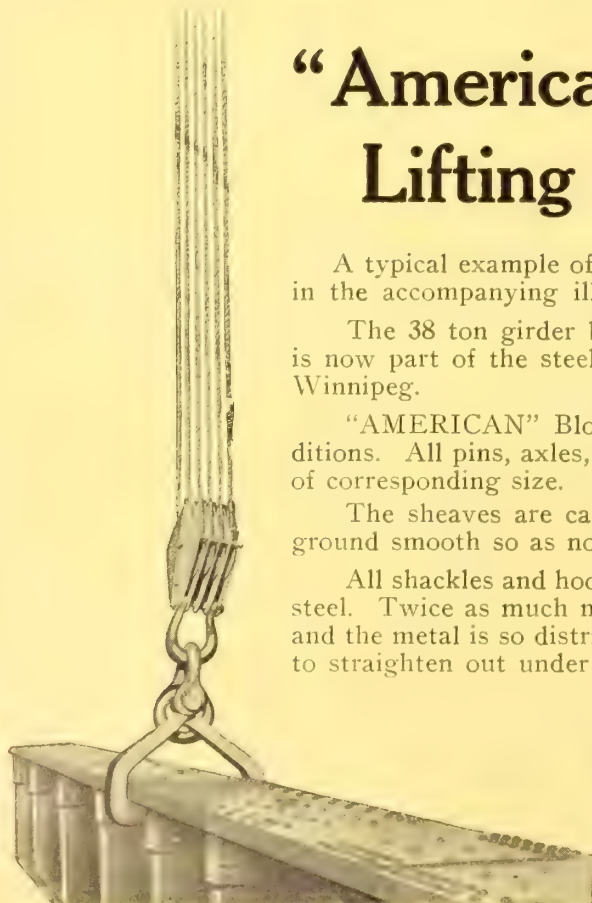
The sheaves are cast from special hard iron and the groove is carefully ground smooth so as not to chafe and injure the rope.

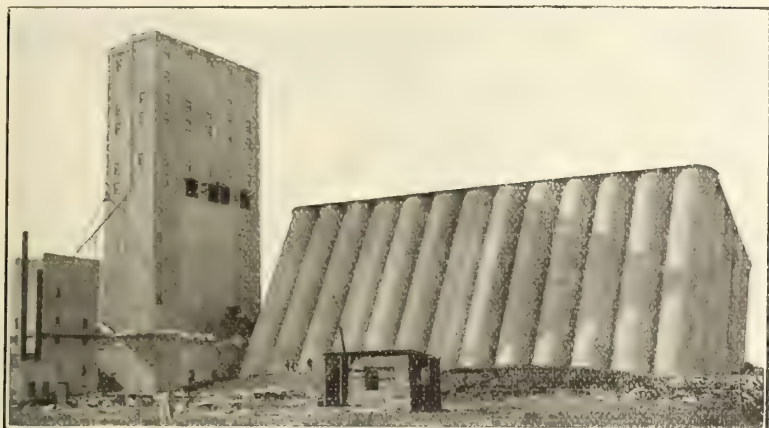
All shackles and hooks are extra heavy and drop forged from special test mild steel. Twice as much metal goes into them as into ordinary hooks and shackles, and the metal is so distributed as to present the greatest resistance to the tendency to straighten out under stress.

MADE BY

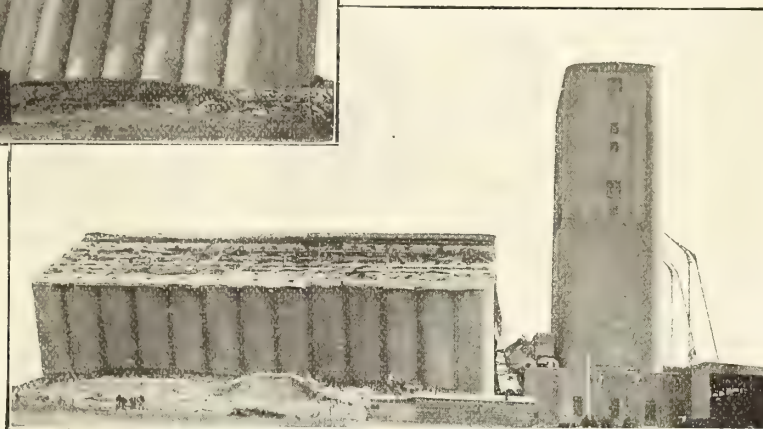
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ST. PAUL, MINN., U. S. A.

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Views of both sides of the million bushel C. P. R. Concrete Grain Elevator at Transcona, Man., which settled on its foundations to an angle of 30 degrees from perpendicular without injury to the structure or its contents.



Concrete Withstands The Severest Tests—

In the San Francisco earthquake and the Ohio floods, concrete structures withstood the terrific tests of fire, water and vibration without damage.

Now, right in our very midst, comes a striking illustration of concrete's enormous power of resistance and durability.

This great concrete structure, built only to resist the pressure of grain from the inside, while filled almost to capacity with 55,000,000 pounds, or 27,500 tons of grain, settled to an angle of 30 degrees from its original perpendicular position.

In the settling, the walls were subjected not only to the terrific twisting strain of their own weight, but to the weight of thousands of tons of grain as well.

Contract for the restoration of this enormous structure has been awarded to Foundation Company, Limited, Montreal and Vancouver, and it is anticipated that it will be put back into its original position without the slightest injury.

No Loss of Contents

Think of the irreparable loss, had this elevator been built of some destructible material—a material that would have collapsed almost as soon as the settling commenced, and which would have entailed not only the loss of the building, but almost a total loss of its contents.

We have published a number of books which contain the most complete information and beautiful illustrations of almost every use of Concrete (Building, Roads and Pavements) for the architect, engineer, contractor, business-man, manufacturer and everyone interested in a material of such permanence and economy.

These books are free and you may have a copy for the asking—simply state what subject you are interested in, on a post card, and send to

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at
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If you let the

SMITH

CONCRETE MIXER

mix your materials, you will get more and better concrete, have less trouble and spend less money on repairs than with any other mixer on the market.

Immediate Shipment from stock

Mussens Limited

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COBALT, Opp. Right of Way Mine

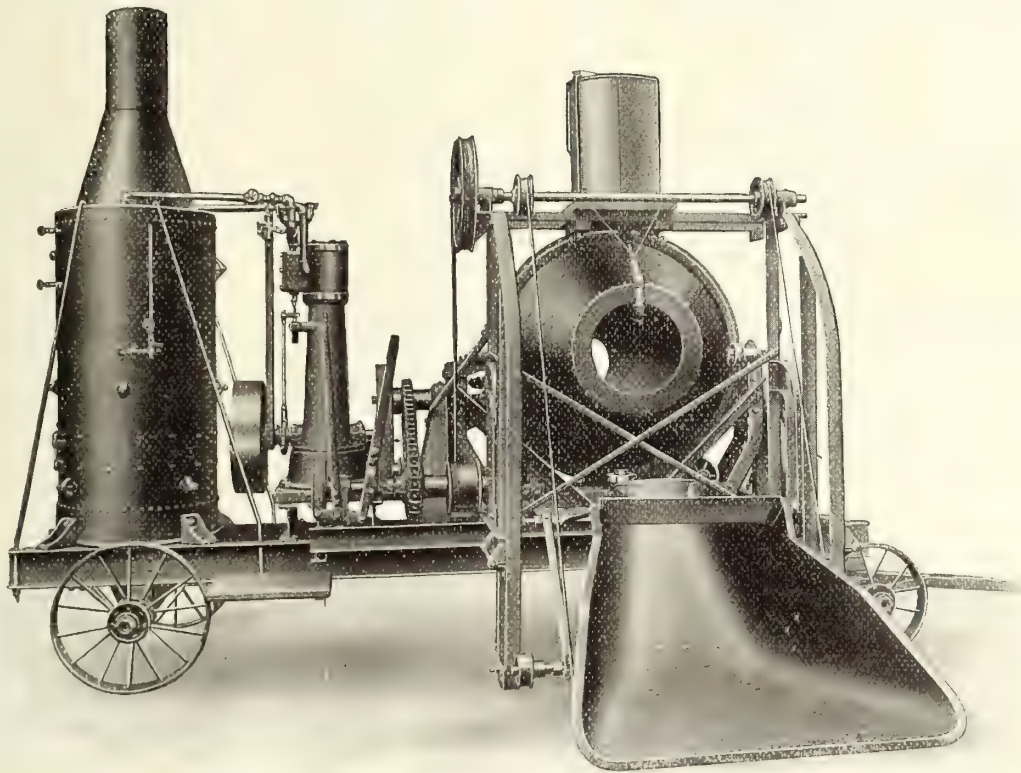
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CALGARY, 10th Ave and 3rd St. East
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NEVER FAIL

The utmost dependence can be put on the **Smith Mixer** that it will work day in and day out without any trouble.



They cost more to buy, but when your job is finished your **Smith Mixer** is ready to tackle another one. They are built to endure.

Catalog No. 45 sent on request

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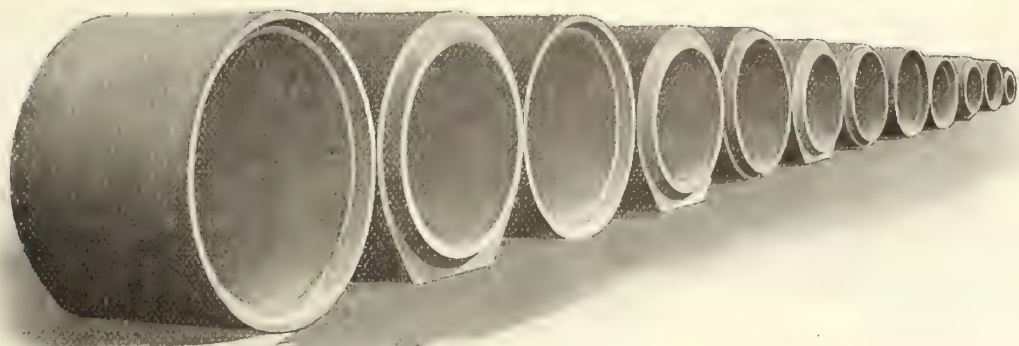
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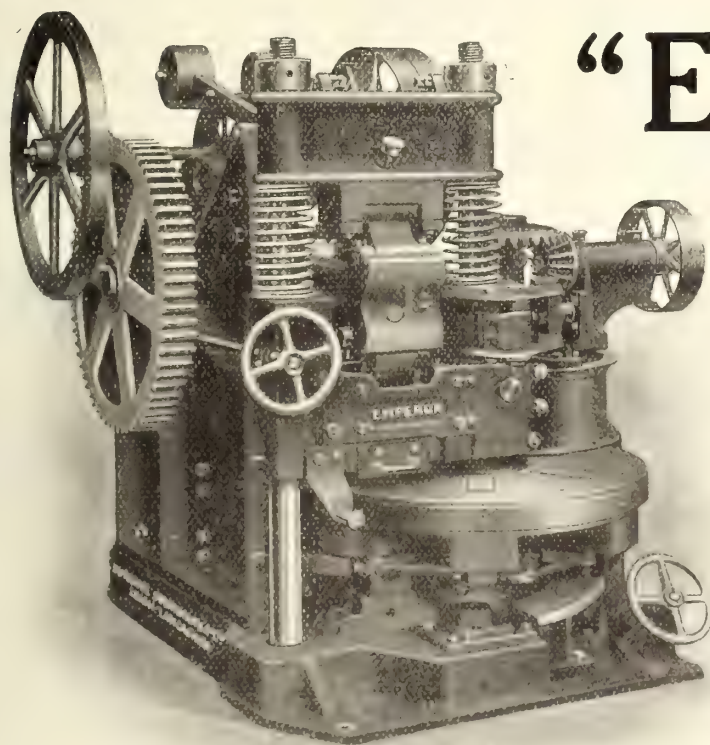


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Our concrete manufactures include a complete line of concrete pipes and building materials. Only the best Portland cement, clean sharp sand and crushed stone are used. These ingredients are proportioned to give the maximum strength and density to the finished aggregate. All our products are **steam-cured**, which method is the latest and most efficient known to science.

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LINDSAY, ONTARIO

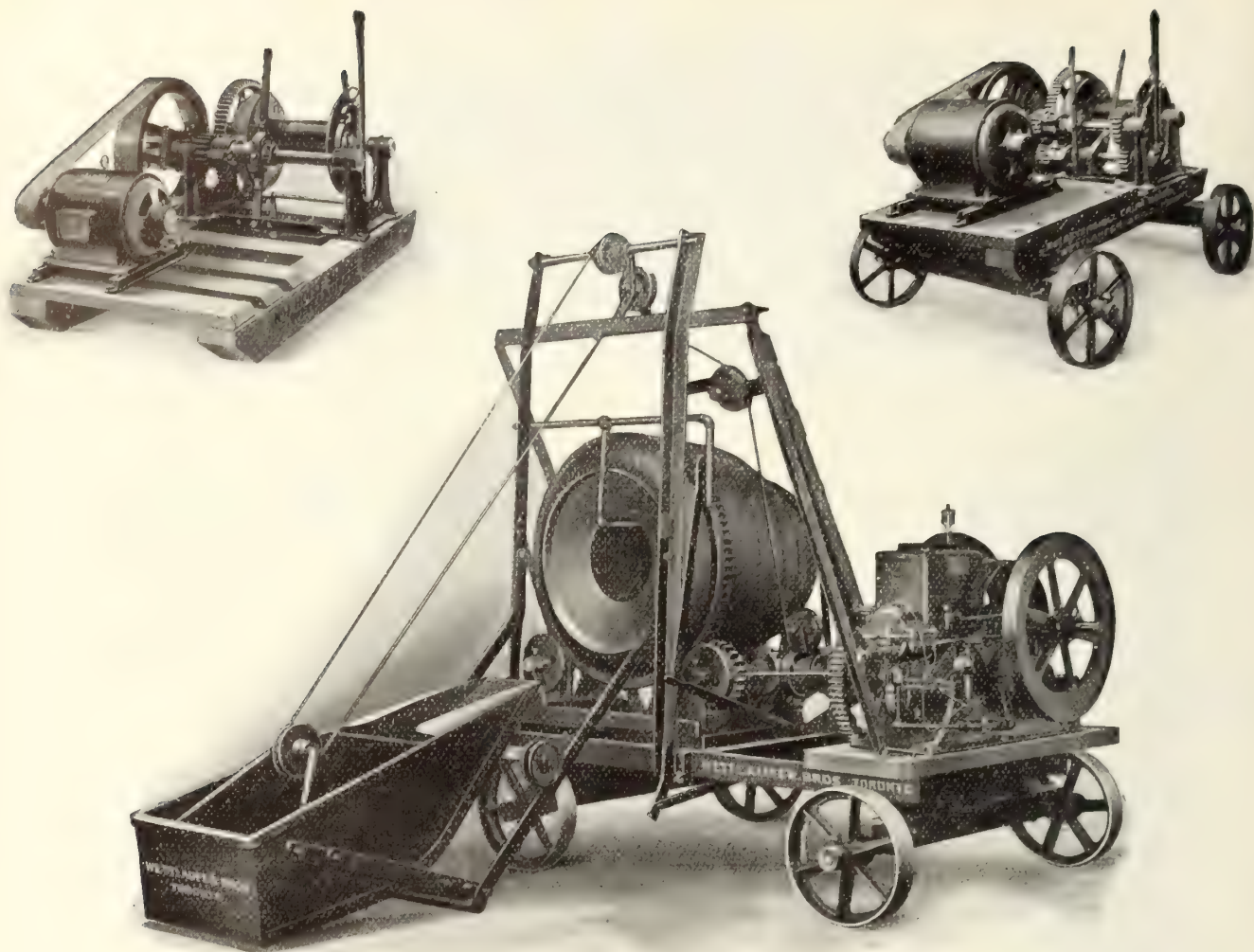


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We can furnish complete brick plants on the most modern lines. Presses for sand-lime, clinker, clay and other bricks.

Write us for literature.

**Sutcliffe, Speakman
& Co., Limited**
LEIGH, LANCASHIRE, ENG.



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Concrete Mixers, Steam and Electric Hoists, Brick Machines, Pumps, Crushers, Stone Screens, Gasoline Engines, Steam Engines and Boilers.

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In A Hurry

With our many mills located at various points throughout the country we are able to make prompt shipments of all orders.

Our cement is the highest grade, suitable for the most exacting engineering and constructional work.

Strength and uniformity are features of Rogers Cement.

SEND US YOUR NEXT ORDER

Alfred Rogers

Limited

28 King St. West, Toronto

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High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

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CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

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OUR BRICK SHOWROOM IN MAIL BUILDING

Keep the following Names in Mind when Ordering High Grade Brick.

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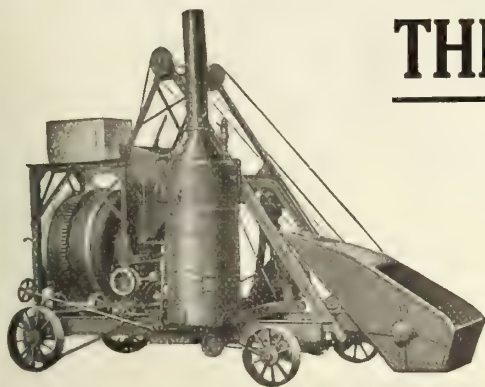
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BLACK BUILDING SUPPLY CO., LTD. - TORONTO

WHY are we the Largest Manufacturers of ? Concrete Machinery in Canada ?

THERE MUST BE A REASON



Rear Discharge Traction Mixer. This machine is also equipped with Boom.

The reason is that our machines have always been made up to a standard, not down to a price. This fact has been recognised by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.

London Concrete Machinery Company, Limited

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SHERARDIZED HERRINGBONE LATH

is the

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of

SUPERLATIVELY GOOD CONSTRUCTION

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Steel & Radiation Limited

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Sheldons Limited
Canadian Sirocco Co.

Forgings
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Dull Co., Raymond W.

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McDougall Caledonian Iron Wks
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Mussens Limited
Rock & Power Machinery, Ltd.
Thew Automatic Shovel Co.

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Ferranti Meters



THE smallest amount of current on the heaviest load is accurately measured on a Ferranti meter. Our meters are guaranteed for three years against all mechanical or electrical defects.

Ferranti meters are assembled and thoroughly tested at our Toronto or Winnipeg warehouses where a large stock is always on hand.

Illustration shows our improved type "C" meter, single or polyphase; top or bottom connections; clock or cyclometer dials.

A postal card will bring complete particulars on Ferranti meters.

The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

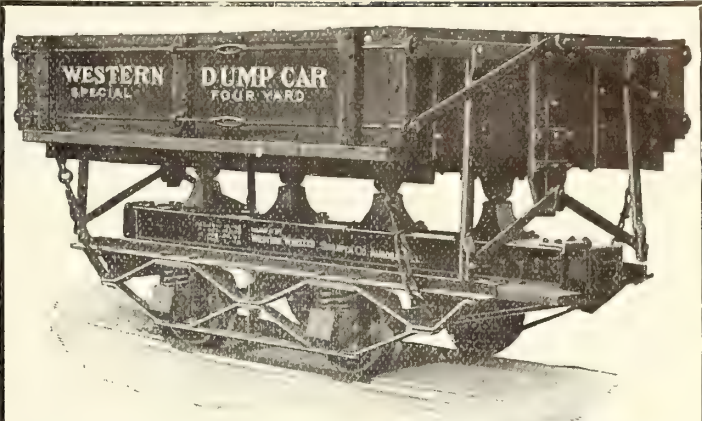
Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG



ABRAM CEMENT TOOLS

have been adopted by many of the leading contracting firms in Canada and the United States—sufficient argument in favor of the investigation of their merits.

ABRAM CEMENT TOOL COMPANY
Windsor, Ont.



It is a well known adage that necessity is the mother of invention. The immense earth moving enterprises undertaken and accomplished in the past few years have necessitated the perfection of a dump car for handling material quickly and economically. The satisfactory dump car which meets every requirement—the dump car of the

Past, Present and Future
is the
WESTERN DUMP CAR

Write for Catalogue.

WESTERN WHEELED SCRAPER CO.
AURORA, ILLINOIS

Earth and Stone Handling Machine

Dominion Supply & Equipment Co., Winnipeg, Calgary, Edmonton—Agents for Manitoba, Saskatchewan and Alberta.
Can. Equipment Co., Montreal—Agents for Eastern Canada.

Macadam Roads



*must be built
of a*

Tough Stone

*that
will cement*

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

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What Big Contractors

Say About This Koppel Car

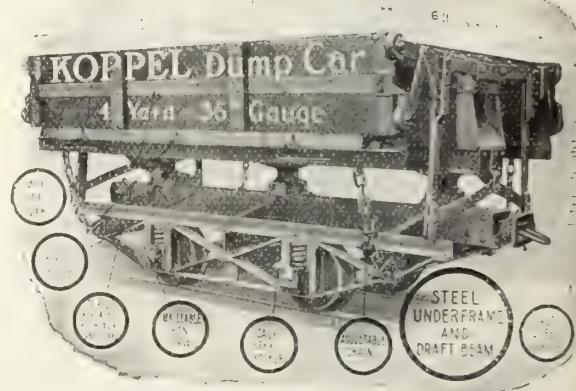
Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.



Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Mixer Performance at Panama was Automatically Recorded by Mechanical Counters

All Austin Mixers in 1912 worked 3,118 eight hour days and mixed 1,209,506 cu. yds. of concrete or one cubic yard every $1\frac{1}{4}$ minutes—this is the average of all mixers from $\frac{1}{3}$ cu. yd. to 2 cu. yd. capacity.

All Austin Mixers in 1912 mixed 1,209,506 cu. yds. of concrete with a total of time lost for repairs of 302 hours or 1 hour per 4,000 cu. yds. of concrete mixed—this again is the average for all mixers large or small.

Two Austin Mixers have records of 225,000 cubic yards mixed each and they are still mixing; **two others** have records of 40,272 cu. yds. mixed each at a rate of $68\frac{1}{2}$ cu. yds. per hour per mixer; **four others** have a record of 5794 hours continuous work without a delay for mixers.

The Austin Cube will do equally good work for you.

Ask our Canadian Representatives

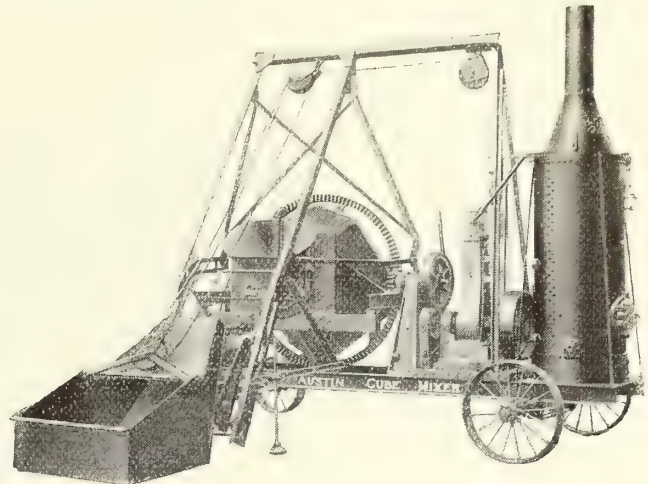
LECKY & COLLIS, Ltd., Napanee, Ont. and 335a Craig
St. West, Montreal, Que.

CANADIAN EQUIPMENT & SUPPLY CO., Calgary

E. G. CULLEN, Vancouver

Municipal Engineering & Contracting Co.

Main Office: Railway Exchange Bldg., Chicago, U. S. A.
Eastern Office: 90 West Street, New York City, U. S. A.



NOTE THE PERPENDICULAR POSITION OF THE Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch **in the air**—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that **does more work**.

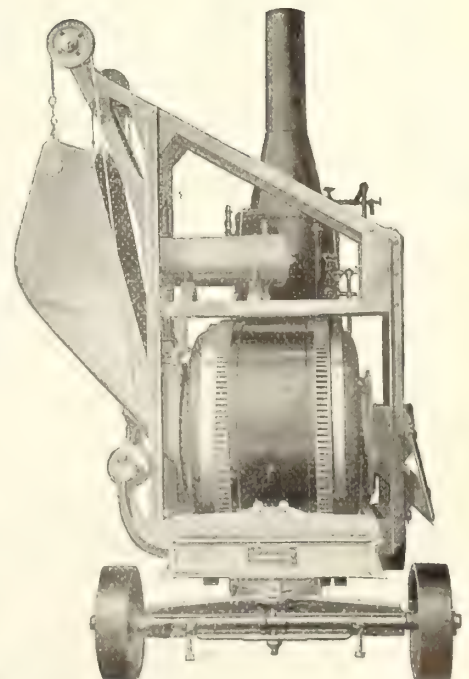
So, to **PROVE** the working capacity of a **KOEHRING** we will place one in competition with **any** other mixer—to do **more work** size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa



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Wrenches

Can. Billings & Spencer, Ltd.

Save Money On Your Lime

This can be done by using lime that will make the maximum quantity of mortar per 100 lbs. of lime.

By using lime that does not require much time for tempering.

By using lime that is always of the same unvarying high quality. In short, use

Renfrew Lime

and you will save money and have a permanently clean-cut masonry job.

Try "RENFREW" on your next job.

Jamieson Lime Company

Renfrew, Ontario

BRICK — LIME — DRAIN TILE

Tarvia

*Preserves Roads
Prevents Dust~*



St. Viateur Street, Outremont, Quebec. Constructed with Tarvia Modern Pavement.

Outremont's Experience with Tarvia

LIKE many another progressive town, Outremont wanted a main street that would be free from dust and mud and have the cleanliness and sightliness of a city type of pavement without high cost. Ordinary macadam would not do, for ordinary macadam is unfit for modern traffic.

Accordingly, Outremont in 1911 paved St. Viateur Street, as illustrated above, with tarviated macadam according to the modern pavement specification. The construction of the roadway cost less than \$1.00 per square yard including everything. The above photograph, taken in 1913, shows the road after two years' wear, still in ideal condition. There have never been any repairs to this street; the maintenance cost so far has been nothing.

The ideal method of maintaining this street in this same excellent condition will be to restore the surface when it gets worn, by a light coat of "Tarvia B" and stone screenings. With such an occasional treatment, this road—bonded and maintained with Tarvia—will give Outremont an ideal pavement for many years to come, at an annual average maintenance expense no higher than the expense for plain macadam.

Tarvia is a dense, viscid, waterproof coal tar product of great bonding power. It changes macadam into a tough Tarvia concrete which is automobile-proof and storm-proof. Tarviated roads are everywhere replacing old style macadam.

Is your town in line?

Booklets on request.

THE PATERSON MANUFACTURING COMPANY, LIMITED
MONTREAL TORONTO WINNIPEG VANCOUVER
THE CARRITTE-PATERSON MANUFACTURING CO., LIMITED
ST. JOHN, N. B. HALIFAX, N. S. SYDNEY, N. S.

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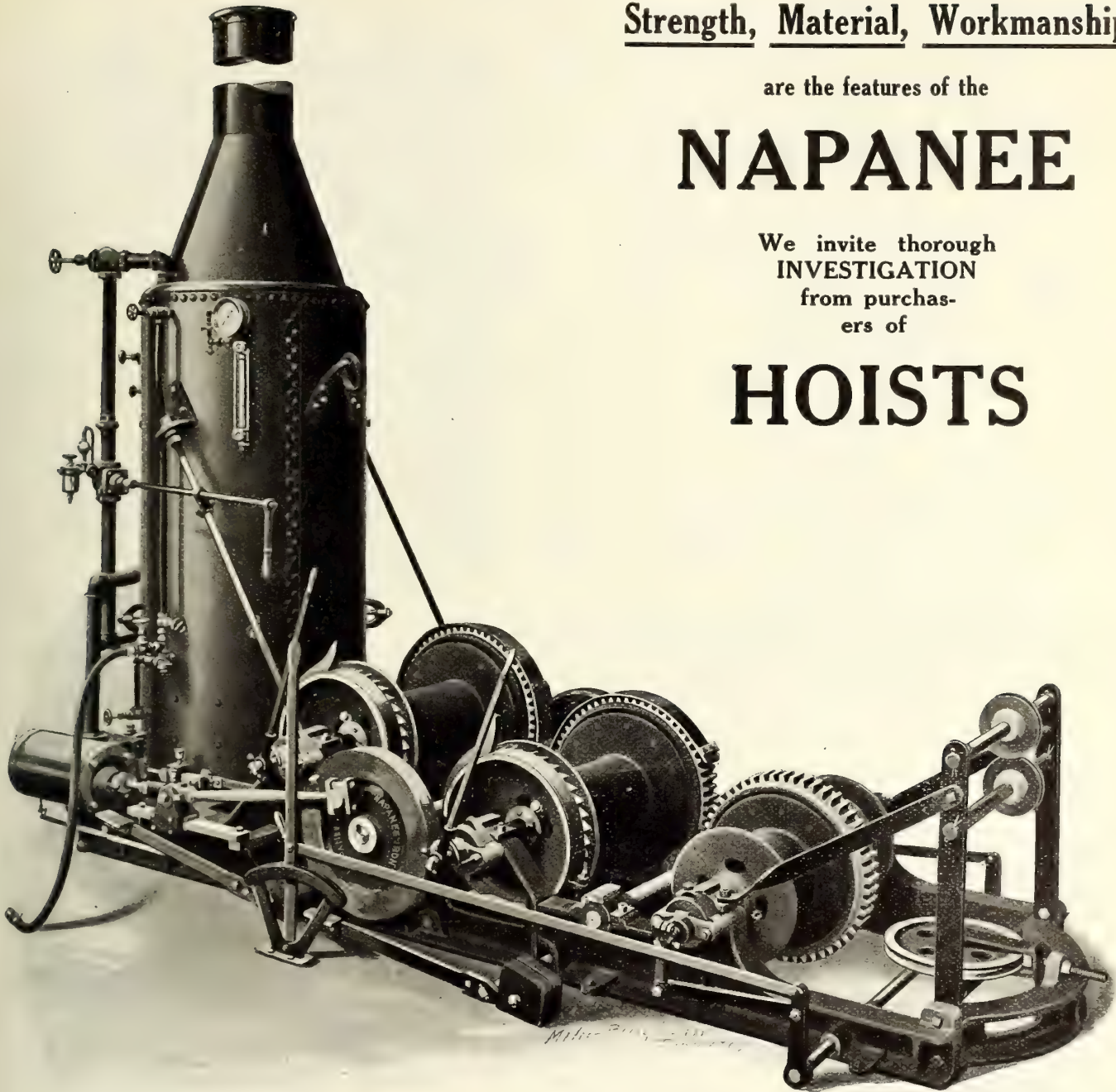
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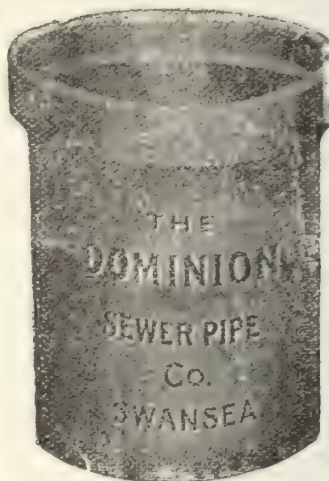
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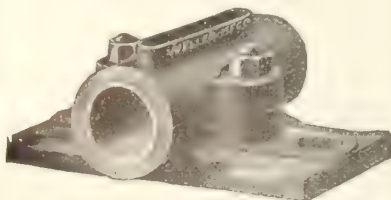
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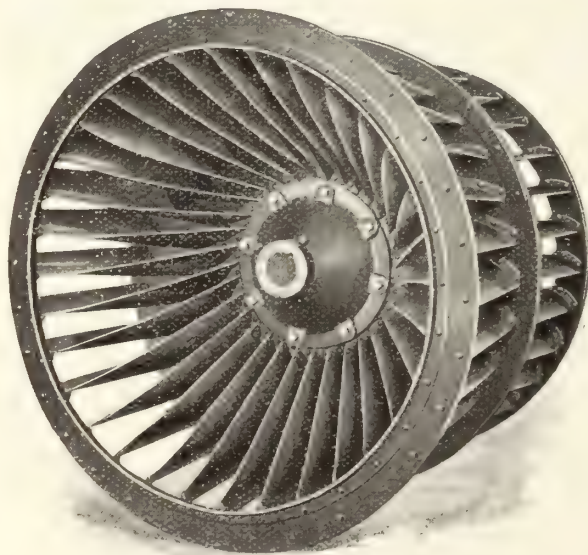
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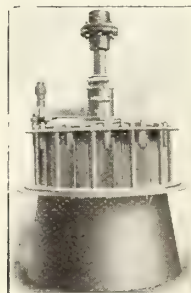
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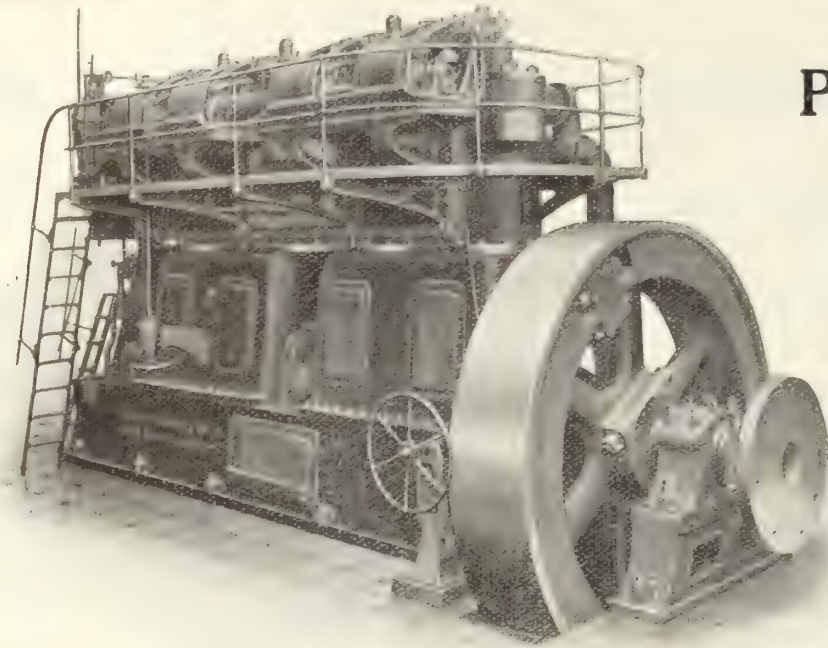
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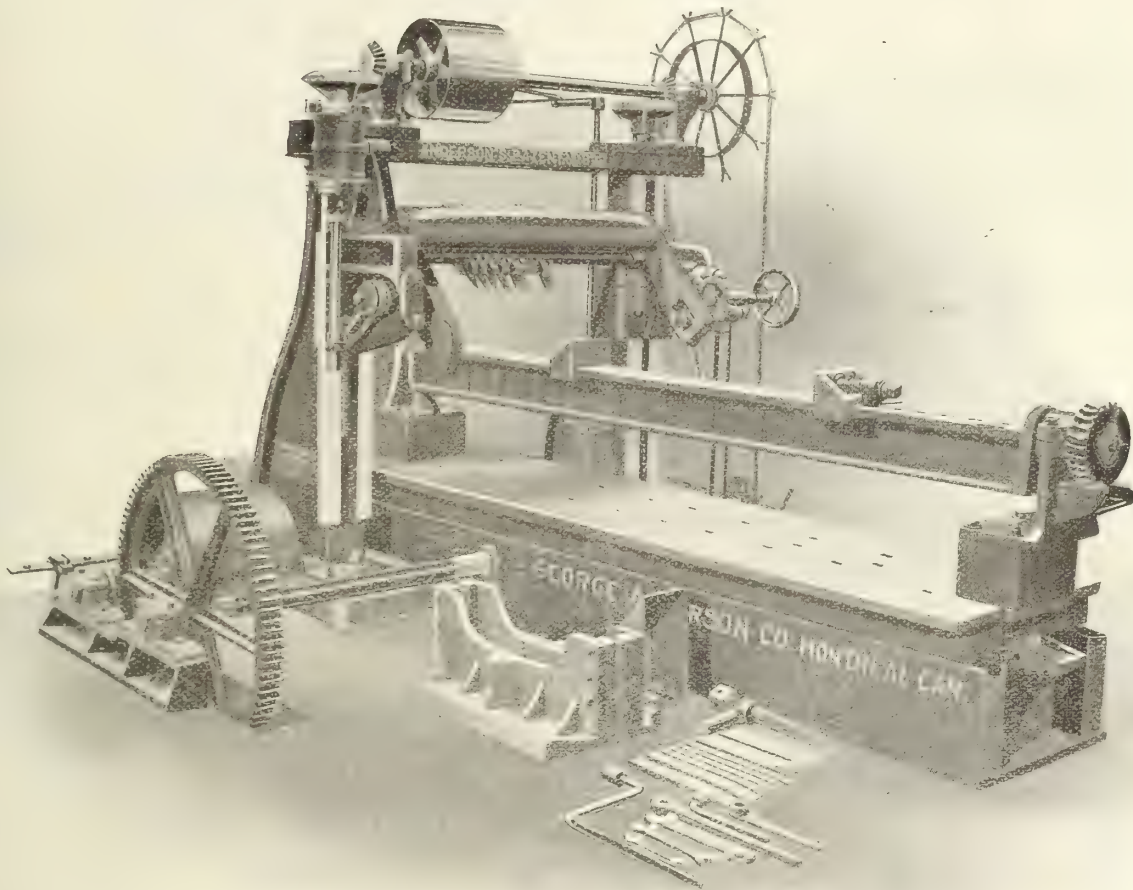
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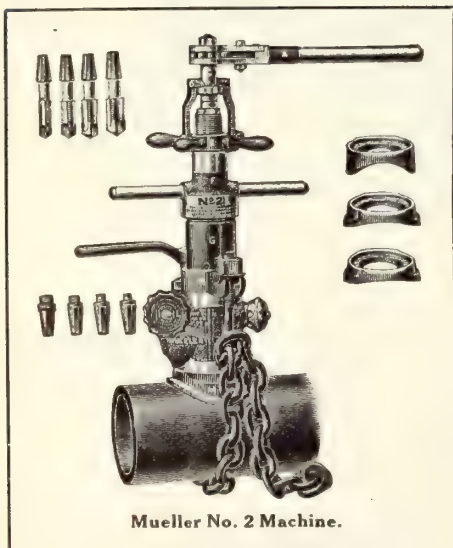
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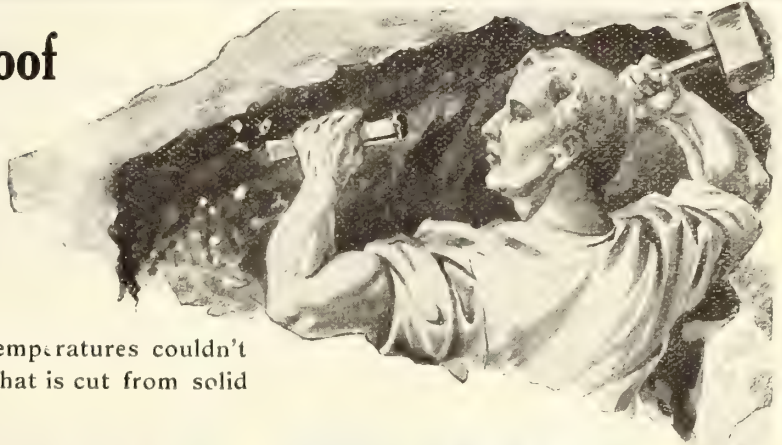
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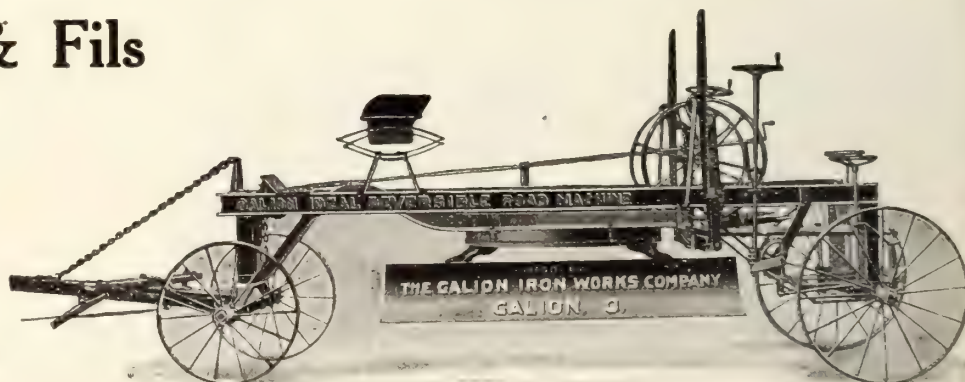
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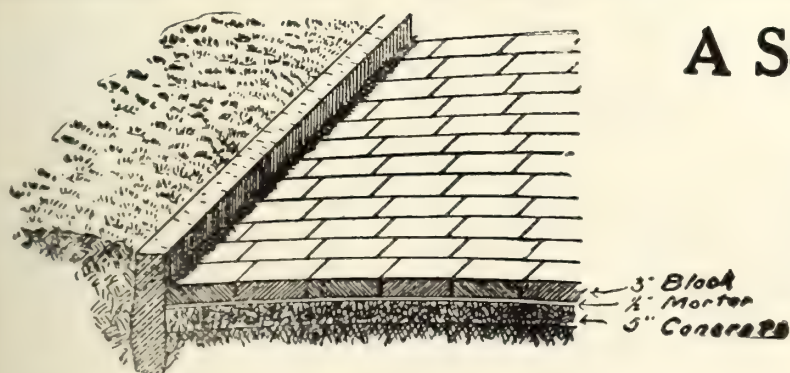
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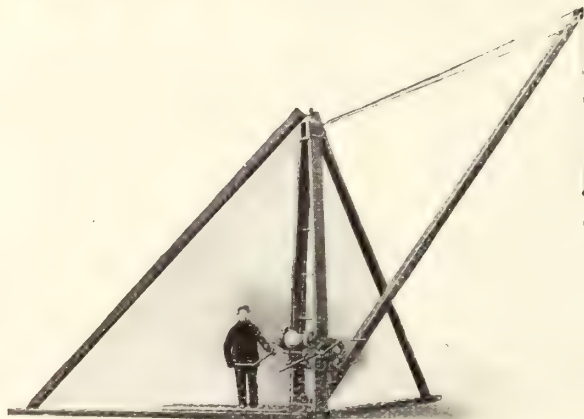
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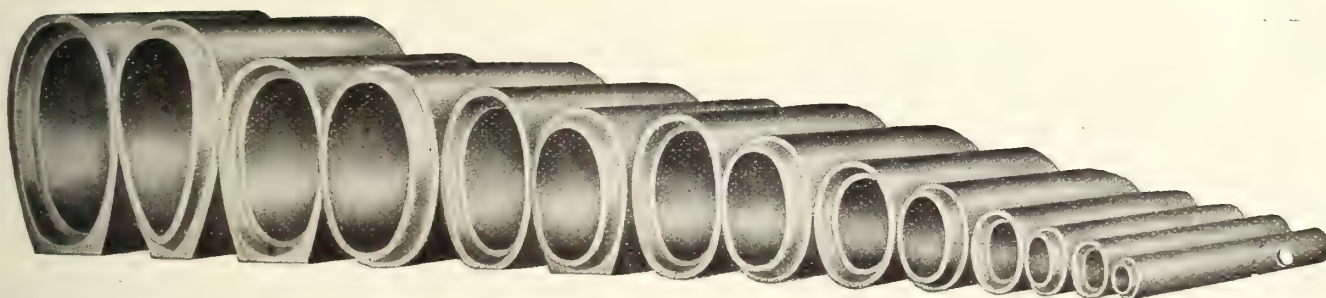
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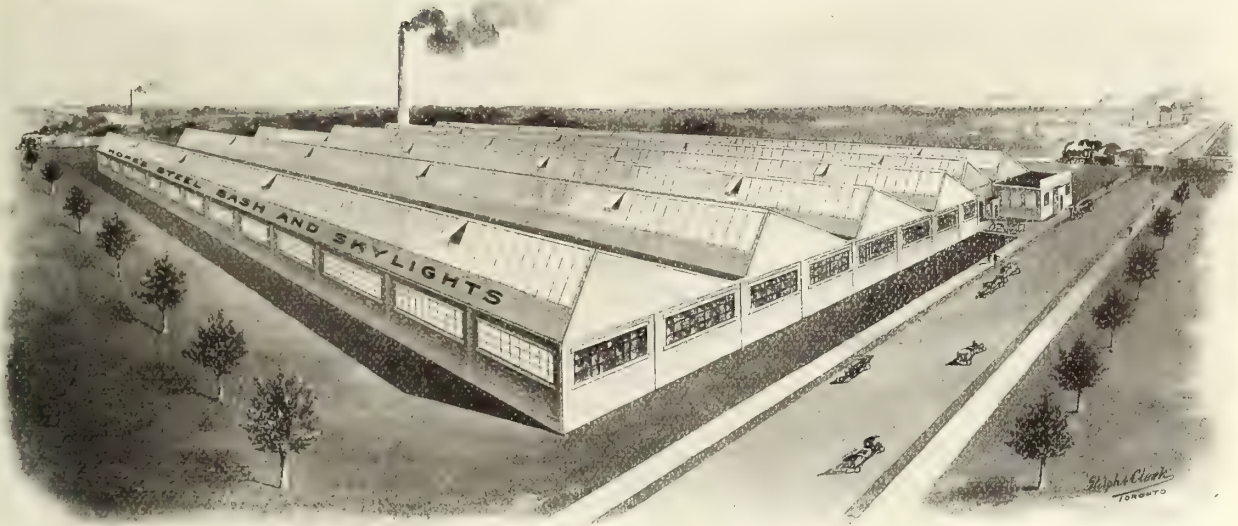
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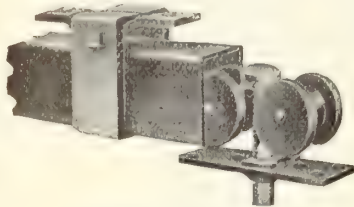
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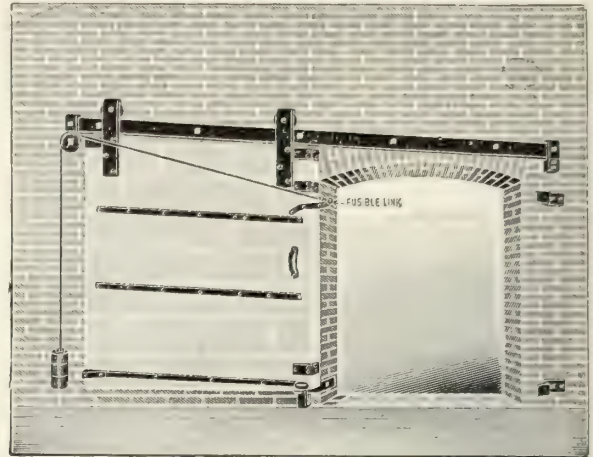
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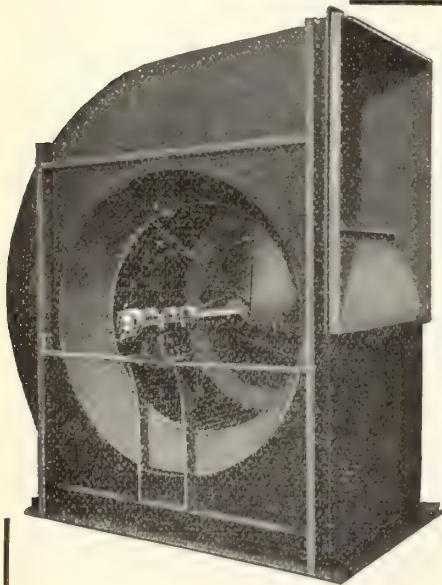


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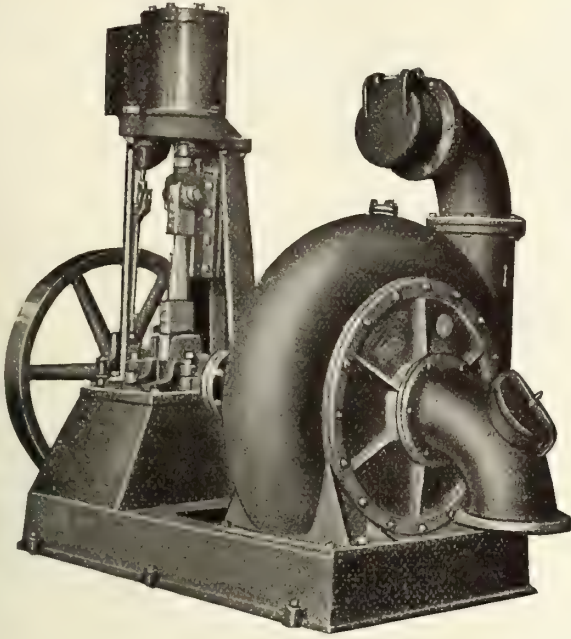
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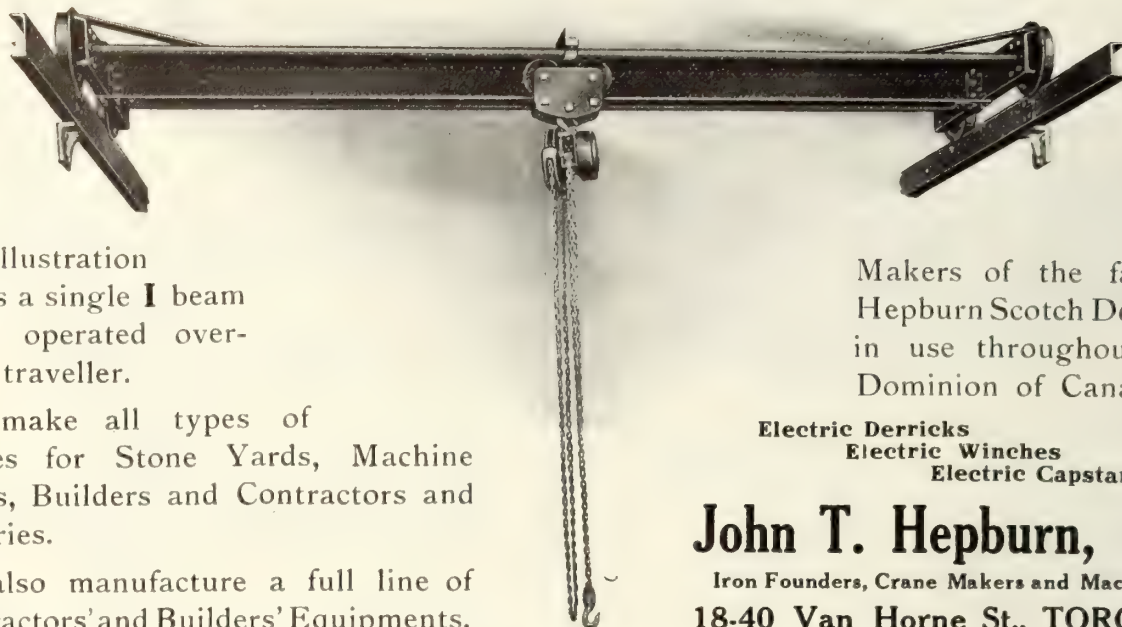
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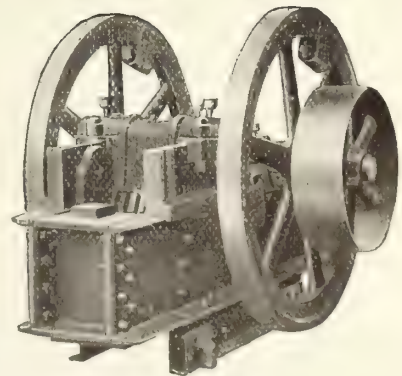
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Maladministration at St. Boniface

EXCESSIVE taxation was one of the principal matters upon which Mr. Chas. Curtis, of Winnipeg, reported at the instance of a representative body of the ratepayers of St. Boniface, Man. The principles underlying the observations of Mr. Curtis have already inspired a number of editorials in this journal, but the report contains much original matter—particularly in regard to contract procedure—worthy of further consideration.

At the outset, Mr. Curtis compares the St. Boniface tax rate of 24 mills with the Calgary rate of 18.75 mills, the Edmonton rate of 16 mills and the Regina rate of 14 mills. Much of the high taxation is attributed to lack of competition on city contracts resulting from an apparent understanding between the council and the officials that invitations to tender are not to be extended to outsiders except in the case of work which is too large or too complicated for local contractors. In support of the contention that this is poor business policy and that it not only keeps up prices but encourages collusion among contractors, Mr. Curtis maintains that the city of St. Boniface has been paying at least 10 and in some cases 25 per cent. more for its work and material than it would have done had it advertised in accordance with the practice of other municipalities. In further detail, Mr. Curtis states that an examination of the file numbers of the Contract Record for 1913 reveals the fact that during the twelve months ninety-five municipal and other authorities advertised for tenders in this journal, the contracts for the various work representing an expenditure of approximately \$250,000,000. The only time that the name of St. Boniface appeared was in connection with a contract for bridge piers and this was done because no local contractor could finance the undertaking. The solitary advertisement, however, resulted in the successful tenderer, an outside firm, bidding \$92,000 lower than the next bidder. "It is not unreasonable to assume," comments Mr. Curtis, "that this sum was saved by throwing the work open to general competition." The report continues that a ten per cent. saving on the contract prices of local improvements carried out in St. Boniface would have enriched the city's treasury by some \$250,000.

Strong arguments in favor of appointing a city manager are brought forward by Mr. Curtis. The various committees, excepting the finance committee, should be discontinued, he contends, and there should be a city manager over all departments. This system has been tried in a great many cities—both United States and Canadian—and always successfully, where the official has been paid adequately and endowed with proper authority. Regina, which is governed by commission and council, with Mr. L. A. Thornton really in the position of city manager, is cited as one of the best examples of this form of government. Regina also has a finance commissioner and has lately decided to abolish all committees. At Westmount, Que., where there is a city manager, the most satisfactory results have been obtained, according to a report presented by Mayor MacKergow at the recent session of the National Municipal League in Toronto. The Mayor of Westmount expressed the opinion that the affairs of the city required quite as much expert attention as those of any private corporation.

"The city you live in," says Mr. Curtis to St. Boniface, "can be likened to a huge corporation of \$25,000,000 paid-up capital, with you as individual share-

holders. Would you as shareholders of a company of this size—or of two millions for that matter—be in favor of running your company with a president and directors who were at work a few hours a day, or possibly not at all, and perhaps at night when the works were shut down? Of course you would not. Then why should you be satisfied to run your city that way? Would you expect results if you paid your directors a few hundred dollars per annum for their services? The only common-sense system in any business is to get experienced and able men and to pay them well for their labor." Mr. Curtis suggests that a solution of the problems that have arisen at St. Boniface may be found in the appointment of a first-class executive engineer to administer the affairs of the city.

It may be mentioned that an editorial paragraph relating to the "city manager" plan which has just gone into effect at Dayton, Ohio, appeared on page 61 of our issue of January 21. We are of the opinion that this system is peculiarly adapted to a city of the size of St. Boniface and in fact to all other municipalities whose funds will not run to employing other than mediocre men who have not the courage to demand final authority in the administration of their own particular business. Therein, perhaps, lies the secret.

In the preparation of this report Mr. Curtis has rendered an appreciable service not only to the city of St. Boniface, but to every Canadian municipality desirous of introspection.

Inviting Tenders by Correspondence

IN our last issue, speaking of the promised activity in road work, we mentioned a few of the items included in the programme of construction drawn up by the Quebec government. Among the work to be undertaken is a stretch of some thirty-two miles of macadam or gravel on the Sherbrooke-Derby-Line road. It would be natural to expect that tenders would be taken for the larger items, but in regard to this particular work, at any rate, we have it from an authoritative source that tenders will be "invited by correspondence." It is possible that the government may have well-defined reasons for cutting up the work into sections and awarding it locally, but as a general principle, in our belief, the system is altogether wrong. There have been countless evidences of large sums which have been lost through carrying out work privately, while the examples of unsuccessful contract work have been remarkably few. The pros and cons in this argument have been discussed at such length, and so often, in these columns that our point is sufficiently emphasized by merely mentioning the matter and citing it as an example to avoid. The trade and technical press is the established medium between the parties to a contract, and its functions cannot be usurped by correspondence. In the interests of all concerned it is to be hoped that in this case the "correspondence" will extend beyond the favored few who usually receive such notification.

It pays to advertise—especially when the advertiser has something of value to dispose of; chooses his mediums with care, preferring the daily and trade papers to all other mediums; keeps posted as to which publications are rising in character and circulation and which are declining; tells his story in a simple, concise and convincing way; takes enough space to tell it; keeps at it persistently; creates an efficient or-

ganization to handle his advertising; rejects all mediums whose main appeal is on the score of cheapness, and, finally, is willing to co-operate with the publisher to secure the best results.

Engineers' Fees

ONE of the most troublesome questions to a practising engineer is that of fixing the amount of the fees that he shall ask for his services. If he charges too much he loses work. If he charges too little he loses the respect of his client. The same man often errs in both directions at different times. In the serious endeavor to find a reasonable middle course he receives little aid from the engineering societies. Their membership is made up in large part of those who receive fixed salaries, who are contractors, or who are in other businesses, and this condition makes it impracticable for them to deal effectively with the question.

The engineer often envies the architect, who has a much more definitely fixed schedule of fees; but it seems hardly possible to use an equally definite schedule in engineering. This is particularly true of preliminary and special work not involving designs or the supervision of construction. Work of this character, although it does not pay the largest fees, is one of the most important from the standpoint of the development of natural resources.

The question is a most difficult one if the rate of compensation must be fixed in advance. This is because of the uncertainty as to the amount and kind of work that may be required. Good business men engaging engineers often want to make arrangements that fix definitely the amount of compensation that they may be called upon to pay. Such limits are often necessary, especially in public works and where work must be done under a limited appropriation. The engineer wants to meet his employer in this, and often goes farther than he ought.

The cases are common where an engineer, in order to meet competition, or, in the absence of sufficient knowledge as to what will be required, undertakes work for a fixed fee that proves to be inadequate. He then usually does as much as he thinks he can afford to do; sometimes he does much more; but it often happens that this is too little and the client is dissatisfied, not because he is paying too much but because the engineer is doing too little. In such a case an adequate fee would be equally advantageous to both parties. Cases of this kind are far too common.

If the work to be done is of a nature so definite that it is possible to know in advance just what is to be done, then the rate of compensation may be fixed with less likelihood of injustice. This is true of the work of making detailed plans and of superintending construction. In many other cases the nature of the work is not known and cannot be known in advance. The client knows that he is in trouble and needs help. He thinks that the engineer can help him. What the engineer can do remains to be determined by trial. It may turn out that the engineer is able to do, and actually does do for him, something that was not contemplated at the time he was engaged, and that it is much more useful than the work that was contemplated. Under such conditions the impracticability of fixing adequate compensation in advance is obvious.

The commonest way of meeting these uncertainties is by the use of per-diem rates. The plan of charging

for professional services according to the time spent is accepted as an expedient. As such, it perhaps comes nearer to satisfying some of the impossible conditions of the case than any other feasible method. It fails to meet the requirement of the client for definiteness because no one can tell in advance how much time will be required. It also frequently works injustice. If an engineer, by reason of possession of special information and experience, is able to render services of substantial value to a client, the fact that only a little of his time is required should not operate to prevent his receiving a substantial fee. On the other hand, every engineer in active practice is sometimes connected with work which for one reason or another is less profitable than usual to his client, and in such cases, in a spirit of fair play, the engineer's usual per-diem rate may represent more than a fair fee.

It is far easier to determine what a fair compensation is after the services are rendered. Then all the essential elements are known with more or less definiteness. Some of the most important engineering work is performed without other arrangement between engineer and client than the understanding that there is to be fair play and that the charges will be reasonable. Under this plan an engineer can often render valuable services to his client which would not be possible if he were restricted in what he may charge by an agreement made before the conditions were known. When the client and engineer can trust each other fully this method has great advantages. Under it

there is better chance of the fullest service and the greatest advantage to both parties. In other professions the advantages of this method, or perhaps the difficulty of other methods, is so great that it has become customary, and attempts to fix compensation in advance are unusual. No one expects a doctor to name beforehand the fee that he is to receive when he is called to see a patient.

One reason why engineering work is not more frequently performed in this way is because clients and engineers have not sufficient confidence in each other. The reason for this may be found in the great diversity in the kinds of engineering work, in the fact that work of a particular kind is often widely scattered, and that the engineer and client seldom know each other as well as men are apt to know their lawyers and their doctors.

Whatever the cause, this lack of confidence is unfortunate and tends to limit the field of usefulness of engineers. This is one of the matters that must be worked out and corrected. Doing it will add to the dignity and usefulness of the profession. The engineer must be faithful to his client's interest all the way through, up to and including the amount of his charge, and must deserve the confidence and trust of his client. On the other hand, if clients can be induced to take the pains to select engineers whom they can fully trust, it will go a long way toward bringing about better conditions.—Engineering Record.

Engineering Topics in the Old Land

Concave Roads a Solution of the Problem of Relieving Traffic Congestion—An Opportunity for Experimental Work in Canada

By our London Correspondent

IF, as was said in a previous letter, "it is somewhat difficult for the English mind to realize the resources of such a country as Canada," it is still more difficult for the Canadian mind to realize the lack of resource in such a country as England. London's traffic is a case in point. Within the metropolis, one reads in the report for 1913 of the London Traffic Branch of the Board of Trade, the number of passenger journeys made by road has almost doubled during the last ten years, while within the same period the total number of street accidents also has doubled. The actual number of passenger journeys by tramway and omnibus during 1912 was 1,349,109,979, or thirteen and a half hundred million. The total number of street accidents in the year was 22,261, of which 561 were fatal. The general conclusion drawn by the report is that "there is a very grave and sudden rise in danger as soon as traffic conditions tend to become congested, due to the large volume of mixed traffic moving at speeds varying between wide limits." The obvious remedy would be so to disentangle this mixture of traffic that fast and slow vehicles ran in definite tracks, and it is therefore astonishing to find among the suggestions put forward for relieving congestion "that slow traffic be compelled to keep to the kerb." It may be said at once that that is the rule now, and the anomaly is presented of such fast traffic as motor omnibuses and taxi-cabs having to break the line of slow moving vehicles on every occasion when passengers are to be

picked up or deposited. Frequently—more frequently perhaps—the fast vehicle cannot reach the kerb, and then comes not only the danger to the passenger but a temporary impeding of the progress of several lines of moving vehicles. The obvious remedy is to have the fast traffic keeping to the kerb; but to bring this about the present cross-section of London streets would have to be reversed.

Concave Roads

In the adoption of the concave road is to be found the only solution of the problem. Here, in England, engineers are content to rub along in the old groove. Innovation does not appeal to them, and had it not been for the advent of the motorist (who is not an engineer) roads would undoubtedly still be made of water-bound macadam. There is no lack of talent in the country, and technical ability of a high order is the rule and not the exception; but engineers are obsessed by the old bogie of conservatism. Too, it is difficult for the highway engineer to make a departure from existing methods, and the man who would be bold enough to construct a concave carriageway would run grave risk of enforced resignation. Ten years ago, when motor traffic was quite in its infancy, the present writer advocated the adoption of the concave system, and every point he then urged in its favor—decreased initial cost, increased comfort, safety and convenience to pedestrians, decreased dislocation of traffic, speedy

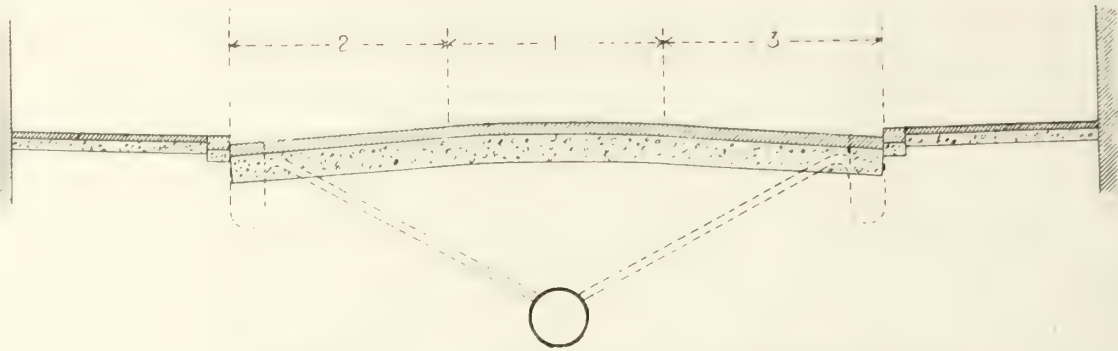


Fig. 1—Cross-section of street with convex carriageway and side gulleys.

removal of slop (by washing to the centre of the road), and facilities for dealing with heavy snowfalls (by ploughing to the centre of the road and piling clear of pedestrians)—applies now with tenfold force. Among the arguments usually advanced against the concave road one of the most fallacious is that regarding cross-section. As will be seen from the accompanying sketches the cross-section, in so far as fall or camber is concerned, would remain precisely the same. In Fig. 1 we have a common form of convex road, composed of two straight lines, joined in the middle by a curve and having a fall to the channels. Cut this now into three equal parts, invert the crown and transpose the sides (Fig. 2) and the required concavity is obtained. The road, carved thus out of a convex one, will have, so far as the haunches are concerned, precisely the same falls to the new channel; whilst the inverted crown will have no more tendency to cause the traffic to slide than it did in its original form, being simply an inverted arc of the same radius. It is scarcely necessary to point out that a concave road would be centrally drained, and that all mud and slop would have a tendency to gravitate automatically towards the centrally-placed gullies, away from the pedestrian side-walk. Safety to life and limb must be the first consideration, however, and this requirement the concave road fulfils admirably, by relegating the slow traffic to the centre of the carriageway and allowing the passenger to enter and leave the licensed vehicle direct from the kerb. Perhaps some Canadian engineer will report favorably to his municipality upon the subject, with a recommendation that a trial section be laid in some busy thoroughfare. The experiment would be watched with the keenest interest here. Tramway tracks must necessarily present some difficulty, but these are always a nuisance to be reckoned

with, and it is to be hoped that the day of the flexible trolley-omnibus is not far off.

The Woman Engineer

It would have seemed a far cry, a few years ago, from concave carriageways to the question of votes for women; but we move in speedy times. It is not long since that a woman was in the running for a county surveyorship in Ireland, and a certain Mrs. Greathead holds now the position of clerk to the Reeth (Yorks) Rural District Council. From the recently issued Blue Book of Occupations and Industries in England and Wales, we see that there are no fewer than 86 women plumbers in the country, of whom 77 are either maidens or widows. Such facts are disquieting or the reverse according to one's opinion on the women question; but they point to the certainty of women municipal engineers, just as there are women sanitary inspectors, plumbers and council clerks. Women suffragists in the Dominion are, we are assured here, elated at the sweeping victory achieved by "the cause" in the Toronto municipal elections, and with a preponderance of women upon local bodies the appointment of women to as many paid positions as possible is at least within the range of practical politics. The women are now, we understand, to advance to further conquests, among which the Parliamentary franchise looms large. The slow-moving traffic is usurping the place of the fast with a vengeance!

A Plea for the Round Figure

There was a story current a good many years ago concerning a certain Chancellor of the Exchequer who, being confronted with a page of figures which had been brought out to decimals, inquired what all those "damned little dots" were. There certainly is a tendency to use these "little dots" much more than is ne-

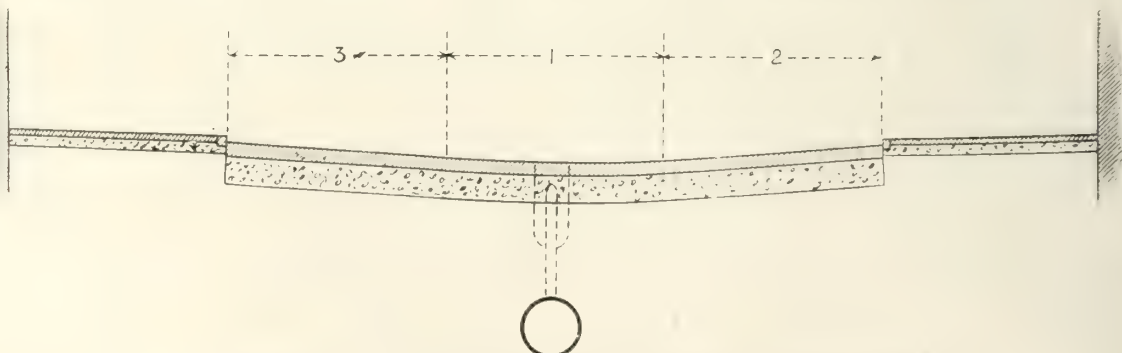


Fig. 2—Cross-section of street with concave carriageway and central gulleys.

cessary. Thus, one reads "The net earnings of the department for light and power is \$72,032.06, an increase of \$30,842.50 over the net earnings of the same month in 1912." The same pandering to unnecessary detail has place here, and such items as £2,490,133 17s. 4d. appear with startling frequency in government and municipal publications. The Decimal Association is doing good work in this country, and the day may arrive when our obsolete system of weights and measures will be relegated to the scrap heap; but meanwhile a Round Figure Association might find plenty of useful spade work to do. Surely, in the instance quoted above, \$72,000, \$31,000 and £2,500,000 respectively would have served the purpose equally well. Such figures are published for general information, and the mind rejects them when overloaded with detail. The requirements of book-keeping are quite another matter.

The Road Board

State, as opposed to local, control of roads is one of those big questions that cannot be dealt with in the space of a paragraph or two. Opinions in this country have always been divided upon it, but the ranks of the adherents of local control have been much swelled since the formation of the Road Board. Any body having an exaggerated idea of its own importance can, by the issue of formidable reports (with detail figures and "little dots" galore) impress those who are not "in the know." The work of the Road Board has been one of incapacity, muddle and failure, and its name is a by-word among engineers here. It was formed in 1910, and its members consisted of a railway director and manager, a shipbuilder and owner, a "Lord Justice Clerk," a "Lord," and a "Baronet." The Board, in its wisdom, appointed an electrical engineer as consulting engineer, and this precious combination got to work with a speed that raised glowing testimonies on almost every side. Among the whole of the technical journals of the country, there was only one that had the courage to make a stand against the flagrant jobbery of the appointments, while highway engineers and surveyors meekly furnished all the information asked for by the Board. The motorists ran the Board from the day of its inception, as they do to-day, and for some months it confined its attention to the rounding off of such corners as were a source of danger to the motoring fraternity. Then came a few rapid motor tours through some of the counties of England, and hundreds of miles of road were reported upon not only in record time but by quite incompetent men. "If the matter were not such a serious one for the community," said the journal to which reference has been made, in connection with some experiments that the Board were to carry out, "it would form an excellent piece of Gilbertian fooling." This journal consistently opposed what it termed "the preposterous constitution of the Board," with the result that later an Advisory Engineering Committee was appointed. Even with this wealth of engineering ability to aid in its deliberations, incredible follies have been committed, for the simple reason that the Advisory Committee is kept well in hand and the motoring interests receive preferential hearing. The trial sections of roadway laid at Sidcup form an excellent example of practical fooling.

An Object Lesson for Canada

A writer well-qualified to speak said only the other day: "I doubt myself if the Road Board has discovered anything that can be regarded as strictly new, for

several of the proprietary processes it has been the direct means of procuring contracts for were well-known to local authorities before they were recommended by this august body." And again "My bone of contention against the Board has always been that practically the whole of its work will have to be done over again in the near future for the reason that it is not making use of its powers to adequately widen the roads to meet the conditions a decade hence. The Board is still without a policy on which to proceed; it is content to leave the roads as narrow and as tortuous as they were; the hedgerows have not been clipped, and little provision has been made in the matter of side paths for pedestrians." The procedure of the Board is rendered delightfully simple by the entire lack of knowledge on the part of its permanent officials. Thus, a local authority asks for assistance in carrying out certain highway improvements. "How much will they cost?" asks an official. £1,500 is quoted. "Give you £200," replies the official, and then follows a little bargaining, and the harassed authority agrees finally to accept £450. There was really no more reason for cutting down to £450 than to £200. It is merely a game of bluff, in which engineering skill has no part. The Road Board spells state control of roads in the end, for the Board is even now endeavouring to obtain control of county appointments, and it is meeting with a measure of success. Board control means that prominent motorists and superannuated army officers will receive the pick of the jobs. The trained surveyor, as a man knowing his work, will be left quite out in the cold. Canada may some day be considering the formation of some body akin to the Road Board, and this brief history of that notorious Department may serve as some guide to what to steer clear of.

The kind of English which we desire to see more extensively in use among Canadian business staffs, says The Financial Times, is not the English of the pedantic precisionist who goes through life in horror of using the wrong preposition in a compound verb-phrase, or putting the preposition at the end of the sentence, or splitting an infinitive, and is afraid to use "and which" even where that collocation is perfectly lawful. Such an attitude nearly always proceeds from an imperfect education—an education which has failed to reveal the fact that the English language is a natural growth of the human mind, and not a system of unalterable and uncontradictable rules like arithmetic and geometry. The kind of English which we want is the English of men who realize that the sole object of language is to convey thought, and who pay some attention to their sentences in order that their thought may be conveyed as clearly and vividly as possible, not in the set phrases and catch-words of a textbook but in words appropriate to their own ideas.

Experience seems to show that with concrete floors it takes a longer time to heat up a structure for the first time than in the case of wood floors. However, after the building has once become thoroughly warmed it requires much less heat to maintain a constant, comfortable temperature than where mill construction is used, so that the heating account in the long run appears to be considerably cheaper with concrete than with mill construction. Concrete Age claims that where the heating expense is of considerable magnitude this feature might very properly be seriously considered in the choice of building material.



Trap Rock Defined

Buffalo, N.Y., Feb. 6, 1914.

Editor Contract Record:

Will you kindly furnish us with a definition of "trap rock," and oblige.

Yours truly,

Oneida Lime Company, Limited.

Trap rock is a rather general term and usually includes all rock that is hard, tough and dense and cracks with an irregular jagged fracture. The geologists would perhaps classify it as Syenite, Diorite or Gabbro. Road men usually include all Igneous rock that are dark in color as trap.—Editor.

Highway Work in Saskatchewan*

Regina, Sask., February 10th, 1914.

Editor Contract Record:

In accordance with your request I herewith submit a concise statement covering the programme of the Highway Commission of this province for 1914.

The amounts voted by the legislature for Public Improvements in 1914 are as follows:—

Chargeable to Income

Roads and Bridges \$500,000

Ferry accommodation 90,000

Chargeable to Capital

Steel bridges on concrete abutments . . . \$300,000

Construction and improvement of public highways 1,200,000

\$2,090,000

The above figures include the entire cost of administration.

It would be a very difficult matter to give you any approximate figures as to mileage. Regarding the class of construction, I may say that we intend to follow along the lines pursued in the past few years. Saskatchewan has not yet reached the Macadam stage of road construction. At present practically all our roads are of earth construction.

I expect a great many miles of new prairie road will be opened up this season while, of course, the maintenance of those already constructed will require considerable attention.

In bridge work we expect to undertake the construction of many wooden bridges on pile foundation and a few steel bridges on pile foundations. These are under the heading above "Chargeable to Income."

Under Capital Account we have an appropriation of \$300,000 for steel bridge on concrete abutments. The illustrations shown in our annual report 1912-13 will best describe the class of bridge we are constructing from Capital Account funds. We have not completed our programme as to location of highway improvements or location of bridges.

It may be interesting for you to know that we are arranging for another road drag competition for this season and expect many more municipalities to enter. The province will be divided into districts after all entries are made, inspection will be made before the dragging operations are commenced, immediately after, and periodically from June until the latter part of September. Four prizes, ranging from \$400 down,

will be given in each district to the municipalities gaining the greatest number of points. The results of the road drag competition held last year show that it is the only solution of road maintenance, especially where so much clay and loamy soils are encountered as in this province.

I trust that this outline will be of interest to you and your readers.

Your obedient servant,

H. S. Carpenter,

Acting Chairman of the Board.

Westrumite—A Correction

Winnipeg, February 6, 1914.

Editor Contract Record:

We note that in a recent issue of your journal, in your "Glossary of Terms Used in Road Construction," you state that Westrumite is "the trade name of a mixer." This is news to us, and we would like to tell you what Westrumite is. It is an asphalt used cold for laying pavements, thus making it possible for the small community as well as the large city to have first-class asphaltic pavements at moderate cost. Westrumite, ordinarily, is laid two inches thick as a wearing surface on either concrete or macadam foundation. It makes a dustless and noiseless pavement, and the granular texture of the surface prevents slipping and skidding, even when completely covered with water. Westrumite pavements are suited to all climates; they are not affected by heat or cold; they neither track in the summer nor crack in the winter.

Yours very truly,

Westrumite Asphalt Paving Company, Limited.

Additional information about Westrumite and any other form of construction is welcome, but the definition complained of in our correspondent's letter was given in error owing an oversight on the part of the proof-reader. Upon turning up the original manuscript we find the following lines:—

Westrumite.—The trade name of a dust palliative.

Whalley Mixer.—The trade name of a mixer.

We are glad to have this correction and hope that the Westrumite Asphalt Paving Company's example in writing us will establish a general precedent.—Editor.

"Vulgarity and Obstrusiveness in a New School of Design"

Montreal, Feb. 12th, 1914.

Editor Contract Record:

The subject you raise under this heading in a recent number of your paper is a live topic and one that is causing a good deal of interest at the present time.

In commenting on the subject one cannot get away from the fact that skyscrapers, or at least high office buildings, have, of necessity, to become sooner or later part of our street architecture in most of our large cities. They naturally arise where the business centre is small in area and sites for good offices are limited and of high value.

The questions that govern the height and surroundings of office buildings should be taken up seriously by the municipal bodies who have the making of the laws governing the erection of such buildings.

A well-designed skyscraper like the Woolworth Building of New York—if detached—or an office building, such as those referred to in your article, at Toronto—have nothing whatever in themselves to criticise adversely as architecture, but what is serious is the placing of these high buildings indiscriminately in narrow streets.

One hardly realizes what is going to happen in our already crowded streets when several of these buildings are placed close together. In New York and other cities in the

*Mr. Carpenter's communication will cover, at least in part, several recent enquiries touching upon roadwork in the west.

States are many cases where two office buildings adjoining one another, or on opposite sides of the streets, have a day population of 5,000 people—a number that in a city like Toronto or Montreal would a few years ago have been spread over a square mile or more of their business streets.

What congestion will occur around these high buildings in our Canadian cities if they are allowed to be built in close conjunction to one another is not considered to anything like the extent it should be by the exponents of the commercial tower.

Architecturally speaking, our business streets require to be treated essentially in a formal manner. Even with high office buildings, a height should be set down by our building authorities to which all buildings should be governed. A defeat of efforts to establish such a limit can be due only to the strength of private interest. The larger public interest is in favor of the restriction.

Tall buildings require a wide street quite as much because of the congestion of travel they bring as because they shut the sunshine out of a narrow street. For this reason, if for no other, a 22-storey building is too high for a street the width of King Street, Toronto, as a 12-storey is in Montreal for a street the width of St. Francois Xavier. As before mentioned, a formal treatment is desired in our business streets, for nothing looks so bad as to see a high and low building in close contact with one another. Such a bad arrangement has been compared to a line of type where the letters are all different in height. Whilst the letters need not be exactly the same form and width, no glaring contrast should be allowed to shock and offend. A uniformity of height or relation to one another of adjoining buildings is being insisted upon by the powers-that-be in our older cities, especially where modern improvements are being made. One recalls the recent rebuilding of the lower end of Regent street, London, England, and the Crescent of Aldwych, where the skyline for the whole of the new buildings was governed by a previously well designed and carefully prepared scheme. This scheme was made in accordance with the views of leading architects and engineers who had been called together by the municipal authorities in consultation. Where such a scheme has not been followed we know only too well how our business streets have become a total failure artistically.

Unless our municipal authorities are broad-minded enough and courageous enough to look forward twenty years or more into the future when undertaking problems for their city's good, I fail to see how our cities are going to develop to the best advantage on sound national and aesthetic lines. Would it not be possible and desirable for each of our municipal councils to have prepared by the best authority available a well-considered plan showing upon what lines it is desirable for the city to develop in the future. Then, after this scheme had received the general approval of the public, all future improvements, buildings, etc., would be for all time based and governed by such a plan. Restrictions in such a scheme would have to be made, but consider what the future ratepayers in a growing city would be saved in avoiding the many expenses found to be necessary now-a-days for street widening, cutting through of new streets, and other such public works.

A city developed on such rational lines, with the necessary open spaces and different types of buildings related to the width and position of the streets in which they are placed, would be a pleasure to behold.

Those that come after us would then feel proud to live in such a city—where foresight and common-sense had played so important a part in their forefathers' time, whereas now we ought to hang our heads at the lack of uniformity in our

streets and the glaring contrasts in the types of the buildings which can but shock and offend.

In New York the public authorities are considering this problem of restricted heights for buildings. Mr. R. P. Bolton has recently sent to the Borough President a report on the subject of which the following is an extract:

"I have suggested to the Commission a limitation of nine times the gross plot area in gross interior floor area. Coupled with a restriction as to cornice heights and permission to build higher only by recession from all sides of the property lines, the access of light and air to street and neighbors would be secured.

"With the increased high cost of construction, it follows that rentals must be high if a proper return is to be secured, but it is a fact that the mere height of buildings does not bring in commensurate returns. There are actually instances in lower Manhattan where the lower floors of some skyscrapers are unrentable as office space and are rented for storage purposes on account of the insufficient light and air they afford.

"This is due to the building itself, which has not only robbed its neighboring properties of their share of light, but has robbed itself of its own share of reflected light. The same applies to access of air for ventilation. Had such buildings been constructed with regard to these features, a much less height would have been found to produce equal results."

This statement is interesting as dealing with the question under discussion and raises important details which it is well for all to consider.

Yours truly,

Philip J. Turner, F.R.I.B.A.

Tentative Basis for Proposed Quantity System

Editor Contract Record:—

It has long been a matter of wonder to many of those identified with architectural and building work that the duplication of labor and liability to error obtaining under the present haphazard methods of estimating should be allowed to continue, and in the light of this your recent editorial references to the subject are gratifying.

Any system introduced into this country must be formulated upon the basis of our present practice in estimating and adapted to the peculiar requirements of our methods. A brief review of the English system will, however, prove illuminating and will plant the red flag over the pitfalls to be avoided in any constructive work.

The quantity surveyor in England receives a fee based upon a fixed percentage of the cost of the work. The fee is placed at the bottom of the money column in the bill of quantities and is added to the total amount of the estimate. The successful bidder pays the surveyor's fee. If no contract is let, custom has established the right of the quantity surveyor to collect his fee from the owner. In the one case the owner pays the fee indirectly, and in the other, he pays it directly. Is there any logical reason why the fee should not in all cases be paid directly by the owner? The conditions of payment under the English system inject into the situation an element of uncertainty as to who does actually employ the quantity surveyor. The courts have held that the architect employs him with the implied authorization of the owner. Nevertheless, in many cases where the bill of quantities has proved deficient, the contractor has believed that he had the right of recovery against the quantity surveyor since he was paying for his services. The question will immediately arise in the mind of the reader: "Why should there be any dispute as to the sufficiency or deficiency of the bill of quantities?" The answer is: that the bill does not constitute the basis of the contract. Here is the most glaring inconsistency in the English system, precipitating innumerable

able disputes and litigations. English practice is to compute the estimates solely upon the bill of quantity. The drawings and specifications are not issued to the bidders, but are on exhibition at the quantity surveyor's office. The estimate and contract, however, place upon the contractor the obligation to complete the building in accordance with the plans and specifications for the amount of the estimate. It is obvious that if the estimate is computed upon the basis of the bill of quantities, the bill of quantities should also constitute the basis of the contract. The lump sum tender should be done away with.

As stated before, the quantity surveyor in England is employed by the architect and paid by the contractor. Payment generally signifies employment; but the English courts have, in only a very few cases, held the quantity surveyor responsible to the person paying him for his services, and in these cases only because he has been guilty of flagrant negligence or gross incompetence. Such a condition will always have the tendency to induce irresponsibility in the quantity surveyor.

As a tentative basis for working out a quantity system, the following code of rules is proposed to govern the employment of the quantity surveyor and the adoption of the quantity system of estimating:

(1) That the quantity surveyor receive a stipulated fee to be paid in all cases by the owner.

(2) That the bill of quantities constitute the basis of the contract—a definite amount of work for a definite amount of money.

(3) That the drawings, specifications, and bill of quantities be issued for the purpose of bidding. The drawings and specifications are essential to the intelligent pricing up of the bill of quantities, since they serve to illustrate the manner in which the materials are to be worked and their character.

(4) That the owner assume responsibility to the contractor for the accuracy of the bill of quantities.

(5) That the quantity surveyor be obliged to pass a state examination and receive a certificate, as does the certified public accountant, before he be permitted to practise, thus establishing his competency.

Let us now consider the various aspects of the operation of the quantity system under the proposed code.

The owner may be expected to object to being put to the supposed additional expense of the quantity surveyor's fee. This objection is quickly disposed of by studying the economies of the present system. Sufficient statistics have been collected to indicate that in this country there is an average of ten bidders for each job put out for estimate. Following the law of averages, each bidder secures one of the ten jobs on which he submits estimates. The cost of preparing all estimates is charged to "overhead" and distributed pro rata over all of the work actually secured. Therefore, the cost of estimating the nine jobs lost is charged against the one job secured. No matter what obscure method of bookkeeping is followed, in the last analysis the fact remains that the owner of the tenth job pays the cost of estimating the other nine in which he has not the slightest interest. Through the adoption of the quantity system the bidders are relieved of the cost of preparing estimates, and the owner pays the cost of the estimate for his own job only.

One of the most certain, far-reaching, and beneficial effects of the quantity system will be the production by the architect of more accurate and intelligible drawings and specifications. The improvement must result from the full and frank co-operation between the architect and the quantity surveyor, in the preparation of drawings and specifications, and from them of the bill of quantities. As already shown, accurate quantities cannot be taken from deficient drawings and specifications. The quantity surveyor will apply to the

architect for information on all points not made clear by the drawings and specifications. Is it possible to conceive of a more thorough check for accuracy and clearness? Conversely, with such co-operation, it must follow that the bill of quantities can be prepared with a far greater degree of accuracy than is now possible.

Each contract should include a clause providing that—the work comprehended in the agreement consists of the quantities of the various materials comprising the bill upon which the bid is based, worked in accordance with the requirements of the accompanying drawings and specifications.

Each contract should also include a clause providing for increased or decreased compensation to the contractor resulting from additions to, or deductions from, the original bill of quantities due to any cause or by reason of subsequent changes in the work, at the rate of the unit prices set forth or deducible from the bid, plus ten per cent. for additions, and at the rate of the unit prices set forth or deducible from the bid, less ten per cent. for deductions; also for priced bills of quantities on extra work involving the use of materials differing in character from any of those originally billed.

In other words, the basis of the contract should be so flexible that it may be extended to cover deficiencies or contracted to cover excesses in the original bill of quantities, and so that it may automatically adjust itself to provide for changes in the work, always upon a fair and equitable basis.

If the quantities constitute the basis of the contract, and the contract prices for the various classes of materials automatically adjust themselves to the changes in the quantity and the changes in the work, there can be no dispute between the architect and the contractor over extras and deductions—and there should be none.

Nevertheless, since extra work carries with it a pro rata increase in profit, it is reasonably certain that a great number of contractors will endeavor to establish claims for extra compensation on the basis of alleged deficiencies in the original bill of quantities. If all such allegations can be reduced to questions of fact, through the establishment of standard rules and units for the measurement of executed work, there will be little chance, unless the architect is extremely negligent, for the contractor to prove a claim for excess quantities if they do not exist. The establishment of such standards as a preliminary step to the adoption of the quantity system is essential to the system's successful operation. Every thousand common brick billed must mean the same number of cubic feet of wall to each and every bidder, to the quantity surveyor, and to the architect. The work of establishing such standards will be taken up by the Association of United States Quantity Surveyors through committees in each trade. The standards so established will be based upon the best and most equitable practice in each trade, with due regard for the distinctions now made between the various classes of work. A bill of quantities drawn upon the basis of such standard rules for measurement and classification will be entirely intelligible to the bidders, because it will recognize the same distinctions and classifications in the work that now govern them in pricing the various departments of work.

Estimating on bills of quantities will reduce competition between bidders to the sound basis of efficiency. In such competition the factors that would count would be the contractor's ability to buy at the lowest cost, his credit, rating, and capital, and the efficiency of his organization and methods in construction. The material man, who stands back of the contractor, would be fully justified in selling at minimum rates where there was no financial risk involved. The "wild-cat" contractor, the contractor without financial standing, and the inexperienced contractor would soon be eliminated. Under such competition they could no longer exist,

for the work secured through taking a chance would net a loss.

The quantity system will impose upon the architect the necessity of following more precise and fairer methods in the matter of making estimates for payments. All payments will be computed upon the basis of units of materials worked, times the unit price fixed by the contract or deduced from the bid. The contractor will receive the exact amount of money to which he is entitled for the amount of work performed—no more, no less. The present method of making estimates for payments upon the basis of shrewd but "safe" guessing as to the value of the work performed, would necessarily be relegated to the past.

All those to whom the proposition has been made of establishing the quantity system have hailed it as being the solution of the one great problem in the field of building in this country, but they have also been pessimistic as to the ultimate success of the movement. However, if the architects of the country will get together and decide upon some method of procedure providing for the co-operation of the intelligent contractor, all obstacles will be overcome and there will be a greater measure of contentment in the lives of all; and that alone is well worth the effort.

Yours truly,

Sullivan W. Jones.*

An Opportunity for a Genius

Saskatoon, Sask., Feb. 10, 1914.

Editor Contract Record:

Without entering into a detailed discussion of your article relating to "skyscrapers," I may tell you that here in Saskatoon we are saved from architectural abortions of the kind by our by-laws, which limit the height of buildings in the business area to 120 feet. This is a wise and timely precaution. Experience teaches us that excess in any style or fashion becomes vulgarity, but unfortunately there are always to be found those who are prepared to risk the stigma of vulgarity in the pursuit of a certain amount of fame (or shall we say notoriety?). Architectural opinion varies as to the beauty or otherwise of the high building. Isolated examples would seem to indicate that here is an opportunity for a genius—some man whose name will become immortal by virtue of his founding a new school of architecture which shall make the skyscraper an object of admiration. General practice, however, has not been encouraging and the by-laws which have settled the question for the city of Saskatoon certainly have my approval.

Yours very truly,

T. Brammall Daniel.

The net profits of the Canada Cement Company for the year ending December 31st last were \$1,536,432, an increase of \$141,756. The net earnings, after all charges and preferred stock dividend had been discharged, were \$409,217, equal to 3.03 on the common stock, against 2.10 in 1912 and 2.06 in 1911. Senator Edwards, the President, in his report, estimates that, with the completion of the Medicine Hat plant, the total capacity will be 12,000,000 barrels per annum, ample to meet all requirements for many years to come. The company anticipated better profits for 1913, but on account of construction work being seriously delayed by the non-delivery of materials purchased during the early part of the year, they did not derive any benefit from the improvement

made in the plants until late in the year, and, in addition to this, construction work at the various mills interfered to some extent with their economical operation. These facts, together with the increased cost of coal, sacks and other materials, prevented the company from making any further reduction in the selling price of cement during the past year. It is their intention, however, to continue the policy of price reductions, and they anticipate that with construction work, except at Medicine Hat, practically completed, they will be able to obtain a decreased cost and effect a saving in distribution to the Western Provinces, which will enable them to make further reductions in the selling price of their product in the West. With a greatly increased capacity they are in a position to do a much larger business than heretofore and to distribute their products to all parts of the Dominion at less cost.

Trap-Rock Crushing Plant at Bruce Mines, Ont.

To prepare immense bodies of trap rock at Bruce Mines, Ont., 40 miles east of Sault Ste. Marie, for use in road construction a large crushing plant has been installed at that point by the Martins International Trap Rock Company. The plant, which is described by the Engineering Record, has a capacity of more than 500 cu. yd. per hour, and is laid out with a view to future enlargement.

Two 110-ton steam shovels, two large electrically operated churn drills and twenty-five 8-yd. steel automatic-dump quarry cars constitute the quarry equipment. The material is hauled from the quarry and dumped direct into a Superior jaw crusher with a 5 x 7-ft. receiving opening. Reduced by this crusher, which is the largest built, to about 10-ft. size, the material passes over a short grizzly, the fines falling on a 4 x 76-ft. pan conveyor and the oversize continuing to two No. 9 McCully crushers. The material from the McCully crushers is discharged to the same pan conveyor, which elevates the entire output and delivers it to a 7 x 18-ft. McCully stone screen. From this screen the fines are discharged upon a 4 x 116-ft. pan conveyor, the oversize going to two sets of 54 x 24-in. Superior rolls. The rolls in turn discharge into the same conveyor, which carries its load to a second 7 x 18-ft. screen. From this screen the larger sizes are delivered to storage piles by gravity and belt conveyors, the fines to a cross-conveyor which takes them to two 4x12-ft. double-deck screens, whence other conveyors take them to other storage piles. From the storage piles the material is loaded on vessels by belt conveyors in tunnels under the piles.

Storage is provided for approximately 80,000 cu. yd. There are two rows of storage piles, and under each row is a concrete tunnel with feeding hoppers in the roof. Each tunnel is provided with a 40-in. belt conveyor 330 ft. long, capable of loading stone at a rate of 750 tons per hour. Near the discharge end of each conveyor is installed a Merrick weightometer, which automatically weighs the material. With the system the largest vessels can be loaded within a few hours.

The layout is such that a duplicate plant can be installed at a later date, or the storage of the present plant can be increased to 120,000 cu. yd. by the addition of one concrete tunnel with loading conveyor and overhead distributing conveyors. The crushing machinery was furnished by the Power & Mining Machinery Company, of Cudahy, Wis.

Messrs. Burke, Horwood & White, Architects, Toronto, have just removed to new offices on the fifth floor of the new Ryrie Building at the corner of Yonge and Shuter streets, Toronto. It is interesting to note that the firm are the architects who designed the remodelling and enlargement of this building.

*Mr. Jones is a member of the firm of Messrs. Palmer, Hornbostel & Jones, architects, of New York and Montreal. This firm has designed many noteworthy buildings in the United States, among which may be mentioned the Carnegie Institute of Technology; the University of Pittsburgh, and the Soldiers' Memorial at Pittsburgh, Pa.; the Northwestern University at Evanston, Ill.; the New York State Education Building at Albany, and the City Hall Building at Oakland, Cal.

The New Waterworks for Port Alberni and Salmon Arm in British Columbia

INCIDENTAL to the installation of municipal systems in British Columbia, such as new waterworks, are constructional problems which are of particular interest and almost unique in their methods of solution. As an example we have the Port Alberni and Salmon Arm waterworks, which were completed last year and turned over to the respective municipalities by the Vancouver Wood Pipe & Tank Company, Limited.

The contract for the Port Alberni waterworks was awarded in September, 1912, and operations were commenced the same fall. The work was to have been completed in eight months, but delays in receiving steel for the banding of the continuous stave pipe occurred and it was not until August of 1913 that the plant was turned over to the city of Port Alberni. The contract was originally let to the Municipal Construction Company, as it was then called, and the price approximated \$108,000. It is a municipally-owned enterprise and marks the development of the first port on the west coast of Vancouver Island, and one of the furthest west in Canada. Railway connection to Port Alberni from Victoria, via Nanaimo, has been completed by the C. P. R. for over a year past, and the Canadian Northern Pacific Railway is fast completing its system on Vancouver Island, which will also reach Port Alberni.

The main points of interest to be noted in the newly-completed waterworks system of Port Alberni are the intake dam of cribwork and rock filling, the supply main, $7\frac{1}{4}$ miles in length, and the distribution service in the city, comprising nearly five miles of six-inch mains, with adequate fire protection through numerous hydrants installed at principal points. The water supply, like most of the plants supplying towns and cities in British Columbia, is by gravity. Very few cities, so far, in the Pacific province, have not been able to provide themselves with water service of this type.

The intake dam of the Port Alberni system is about 200 feet long. It is erected on China Creek, the source

of supply. To reach the dam and lay the pipe line on the route selected, a roadway had to be made for the entire distance, considerable difficulty being experienced. The whole ground was rather rough, and for the most part it was heavily timbered, trees six feet in diameter having to be cut out of the right-of-way. Heavy rock work was encountered in many places. Some idea of the magnitude of the task of even building this road may be gathered from the fact that 6,000 yards of rock and over 22,000 yards of earth had to be handled.

The roadway was brought to pipe line grade all the way, as the pipe was laid on the inner side next the bank, so that the covering could be done by simply excavating the slope and letting the earth down on the pipe after it was constructed. This made the work of construction all the easier, as it had not to be carried on in a deep trench. An important feature of the road-making and pipe-laying was providing for six inverted syphons. This was necessary because of the contour of the line, which crossed several deep ravines, almost amounting to canyons in one or two instances. The roadway had to be raised in places a height of 20 feet, to make it conform to the extreme curve plotted for the pipe. It required no less than 30,000 lineal feet of crib timber for this one item of the construction.

For the first 26,000 feet the pipe is sixteen inches in diameter, the continuous stave type of construction being adopted. Douglas fir, clear stock, well seasoned and carefully selected, was used for the staves, which were dressed to radial section of $1\frac{5}{8}$ inches thickness from 2 x 4 stock. The slotting of the ends of the staves to hold a metal tongue, which keeps the staves in place in the pipe, is perhaps one of the most important features of continuous stave construction. It is one which certainly requires extreme care. To secure absolute uniformity in the interior of the tube, the Vancouver Wood Pipe & Tank Company have perfected and patented a machine which cuts the slot in the end of every stave with unvarying accuracy. The slot is cut



Waterworks system Port Alberni, B.C.—Dam and crib work.

parallel to the width of the stave and the metal tongue, which is two inches wide, is made long enough to project slightly past each edge of the stave and thus engage the edge of each adjoining stave as the pipe is drawn up by the bands. The banding of the pipe was with half-inch round steel, spaced an average distance of $2\frac{1}{2}$ inches. Many curves had to be made in the pipe, owing to the contour. These were in addition to the inverted syphons, so that both lateral and vertical bends are demonstrated in this pipe line, which is an excellent example of the adaptability of the continuous stave type of wood pipe for a country such as that where it had to be laid.

For the remainder of the supply line to the borders of the city, steel pipe was used. Of this, 7,300 feet was 12-inch and 5,800 feet 10-inch diameter. The total elevation of the intake dam above sea level is 614 feet, which was too great a head for regular working pres-



Waterworks system Port Alberni, B.C.—A section of the pipe line, showing the heavily timbered and rocky country through which it was laid.

sure. Reducing pressure valves were therefore placed on the 12-inch and 10-inch steel pipe, and the pressure was brought down to an average of about 110 lbs. in the city.

Wire-wound wood stave pipe was used for the 4 or 5 miles of six-inch distribution mains in the city. House services were connected up at the time these distribution mains were laid, the whole being under the direct supervision of the city engineer. Port Alberni now has every advantage to be derived from a complete modern water supply, and it has sufficient for a population of 20,000 people, which it will be some time in realizing, bright though its future is now, with railway service established and to come. A noteworthy point in the history of Port Alberni, and of the province, is that here was erected early in the sixties of last century, by Capt. Stamp of Boston, the first saw mill, in British Columbia. The mill has long since been removed, but a more modern one has taken its place.

Another water system installed in 1913 by the Vancouver Wood Pipe & Tank Company, was that of Sal-

mon Arm, a thriving town in the interior of British Columbia, on the main line of the C. P. R. and on the shores of Shuswap Lake. Here a service was given by means of a main and distribution pipes of several miles in all. The supply was taken from Canoe Creek at a head of 700 feet, which was reduced by breaking into a 50,000 gallon tank, from which direct service through the city is given. To render it frost-proof, the tank was housed in an octagonal frame building, as the winter weather in that part of the interior is severe at times.

A large contract carried out successfully by the Municipal Construction Company, as this concern was formerly known, was that of installing over 55 miles of steel pipes in the waterworks system of Burnaby, one of the municipalities of Greater Vancouver. This work was completed just prior to the beginning of the Port Alberni contract in 1912. In 1910 and 1911, the same company successfully completed the installation of a 25-inch steel main, 74,000 feet in length, for the city of New Westminster. This was for a supply from a new dam built by the Vancouver Power Company at Coquitlam Lake, just east of Burrard Inlet, in the mountains, near Vancouver.

Mr. J. S. Reekie is President, Mr. W. Stocks, Vice-President and Mr. S. Reekie, Secretary-Treasurer of the Vancouver Wood Pipe & Tank Company, Limited. Mr. J. C. McKenzie was superintendent of construction on the Port Alberni contract and also acted in this capacity on several previous contracts. Mr. E. J. Cosens is superintendent of the factory, which is located in Vancouver City, as is also the company's office.

HOW the old C. P. R. bridge over the St. Lawrence river at Lachine, erected as a single track structure in 1885, has in the last two years been practically rebuilt as a double track bridge, without any interference with traffic, was narrated to the Canadian Society of Civil Engineers in a paper read by Mr. P. B. Motley. Two independent single track bridges were built and the old bridge removed in sections. While this was being done an average of 18 trains a day passed over the bridge during working hours. This was accomplished by cantilevering spans from the piers supporting the old bridge, by sinking pneumatic caissons, by employing floating barges, and transferring traffic from the old to the new spans as the latter were completed. In the old structure the entire weight of metal work was about 4,100 tons; in the new bridge 14,231 tons. The total quantity of masonry and concrete in the original piers and abutments was approximately 12,400 cubic yards. In the additions to the old piers and in the new piers there are 13,300 cubic yards. The number of rivets in the new bridge is approximately 3,500,000. The cost was slightly under \$2,000,000.

A concrete hardening material now being introduced contains 95 per cent. iron dust or iron flour, which is mixed with cement for finishing the surface of concrete floors. From 15 to 25 lbs. of the material is mixed with 100 lbs. of the cement while dry, and one part of this mixture to two parts of sand makes the slush for the top coat, which varies from 1-2 to 1 in. in thickness. It is said to make a hard and durable floor, which is waterproof and not slippery. The hardening material is used also to make new concrete adhere to old concrete in repair work.

A New System of Reinforced Concrete

"Vibrocel"—Its Theory and Its Special Application to Subaqueous Work. Economy and General Efficiency of this Construction.

By J. E. Holdcroft, A.M. Can. Soc. C.E., Vancouver

THE special application of "Vibrocel" to subaqueous work being mentioned in the heading of this article, the question may arise in some minds, "Is there any need for a new system in this particular class of work?" A glance at the difficulties and the almost-prohibitive expense connected with the construction of works of a permanent nature below the surface of the water in rivers, harbors and the like, immediately suggests an affirmative answer.

A new system is needed—one which will combine the advantages of massive solidity of construction, adequate reinforcement against extraordinary stresses, and moderate cost—one which will not require the construction of heavy false-work, costly both to build and to remove, or necessitate the use of the huge and expensive travelling cranes and other gear familiar to

and towards decreasing its cost, whether first cost or up-keep, is worthy of careful consideration.

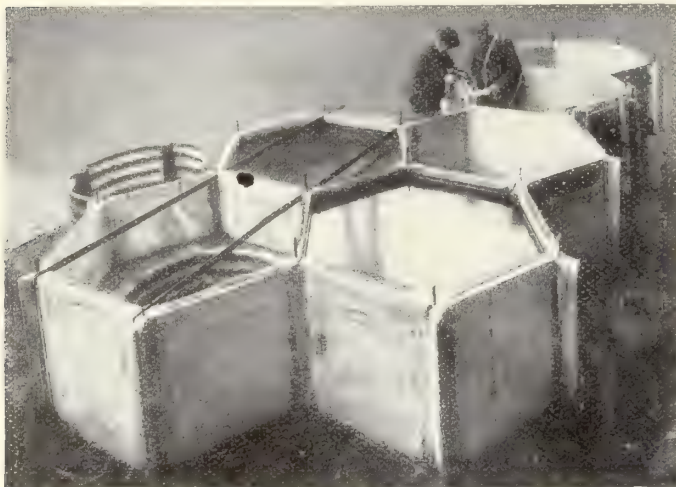
The coined word "Vibrocel" embodies the two main features in this system, viz., the vibration of the concrete and the cellular construction of the sections or units. Neither of these two features is new, but it is their combination which makes the cellular construction economically possible, while the carefully thought-out details eliminate to an almost unprecedented degree, that handling of heavy loads and the scaffolding which is such a costly item in most large structures.

Now, while, as stated before, vibration of concrete is not an unknown process, yet, so far as is known, no attempt has ever been made to vibrate concrete "in situ" previous to "Vibrocel" experiments. A comparison of the results of ramming and vibrating concrete will serve to point out the advantage of the latter process.

If a sample of fairly dry concrete be rammed in a form it will have a tendency to "bridge," like sand under similar conditions, transferring the weight of the rammer's blow to the side forms and tending to burst them. Even when a very small quantity of the mix is rammed at a time, the object of the ramming is partly defeated by the bridging action of the grains of aggregate themselves. It may be contended that this is only so in the case of so-called "dry" concrete, and that if the mix is made "sloppy" it is possible to secure the maximum density. But a moment's consideration will show that ramming or spading "sloppy" concrete does not consolidate it, but only serves to keep it in a state of emulsion. The result is that a much larger quantity of water than is required for the actual setting process is incorporated in the mass, which, when the superfluous water has finally evaporated, is left in a porous condition and is also liable to a considerable shrinkage. This shrinkage causes the surface of concrete walls or floors to be covered with a network of hair cracks into which water can penetrate.

The destructive effect of frost on such concrete is well known. It is true that these hair cracks, or at any rate the outward appearance of them, can be eliminated by various means to a greater or lesser extent, but they exist nevertheless, and serious damage is caused by them, as is shown by the fact (to take a single instance) that in Norway, concrete as a construction material for quays is being abandoned on account of the destructive effect of frost. Compare with this the results of vibration on concrete, whether a wet or comparatively dry mix. Consolidation is at once effected, the grains of sand and aggregate being brought into the closest possible contact, to such an extent that the superfluous water, with even some of the excess of cement, is forced to the surface, leaving only sufficient to fill the small percentage of voids in the closely compacted sand. By this means such a dense mass is obtained that further shrinkage is impossible, and the hardness and strength of the original stone is rivalled, if not surpassed.

The further results of vibration are so remarkable



Vibrocel cells in the making, showing two-inch cell walls, with reinforcement, absolutely watertight; reinforced pillars and staples; bar reinforcement; and in cell on left hand method of strengthening outer cells of floating units of sea walls.

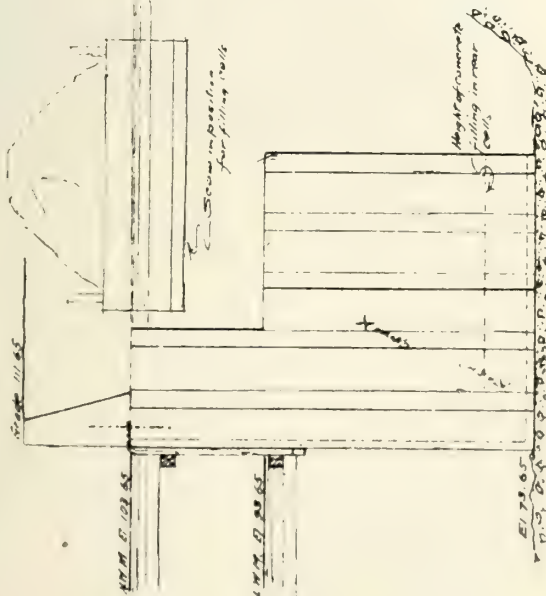
those who know the so-called "block system" of concrete construction in harbor improvements.

These requirements, almost Utopian (if such a use of the word is permissible) in their character, the inventors of the "Vibrocel" system claim to have met almost perfectly.

It is only a very few years since a new definition of a civil engineer appeared in one of our professional journals. It stated in words characteristic of the time: "An engineer is one who can do with one dollar what any fool can do with two." Rude as the expression seems, it is nevertheless very true, and it emphasizes the fact that economy and efficiency (neither of these alone, but both together) is the slogan of to-day, which alone justifies to the men of finance and commerce, our real employers, our existence as individual professional men and as a body of engineers. Any new thing, therefore, which tends towards increasing the efficiency or usefulness of a structure

Fig 1

Section on sand or gravel bottom



Section on Rock

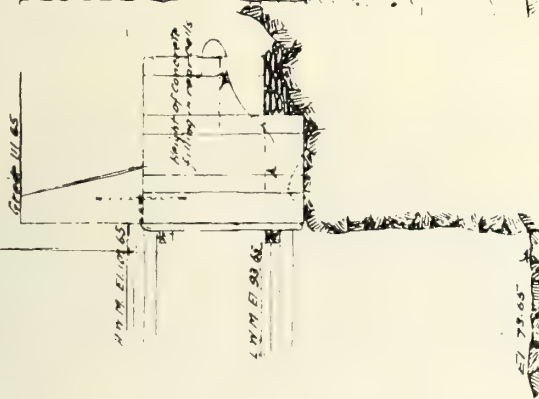


Fig 2
Elevation of section on rock

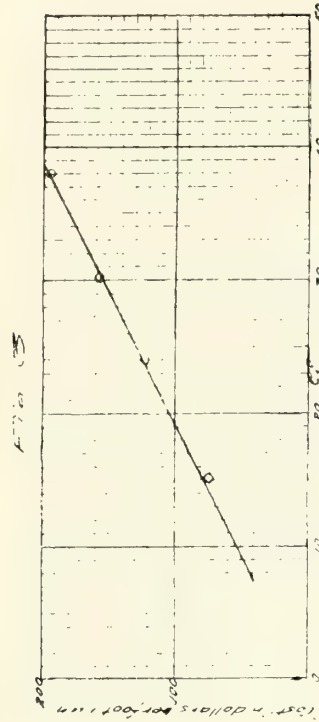
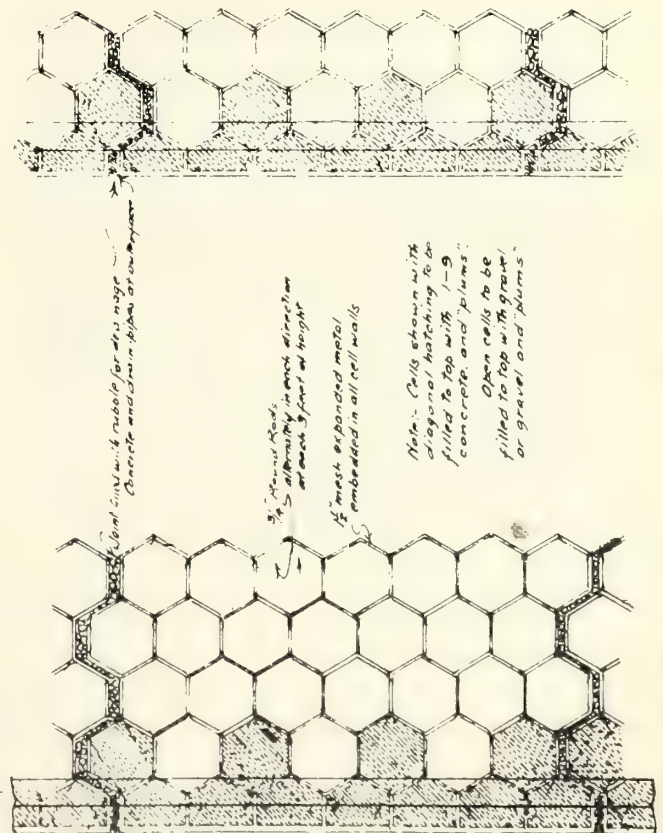
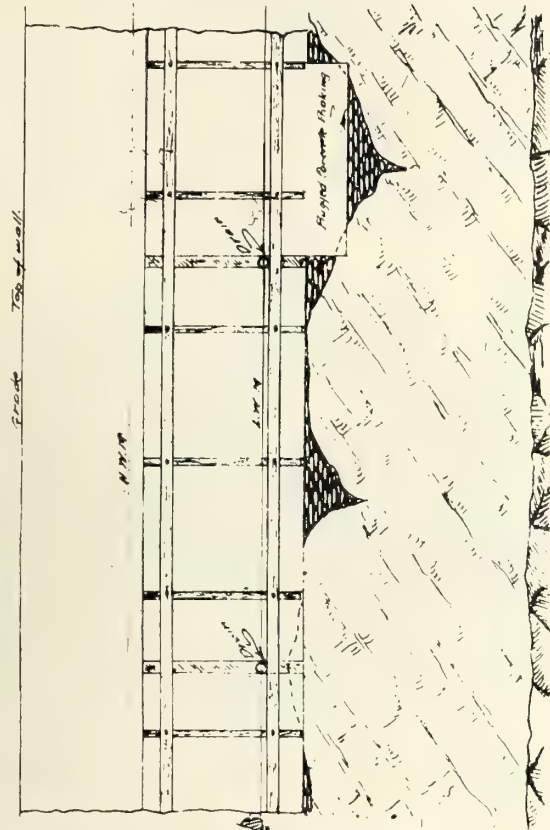


Diagram showing estimated cost of wall for various heights.
Note: This given answer will show complete but does not include drawing.

PROPOSED CONSTRUCTION OF QUAY WALL

UNDER THE 'VIBROCEL' PATENTS.

Scale 10 ft = 1 inch.

Dec 21, 1913

J. B. Haddock, Civil Engineer
218 - 113 Ave E Vancouver B.C.

that we would hesitate to mention them, were they based on theory alone, and not, as is the case, on personal observation and reliable tests. For instance, vibrated concrete is not only water-proof in the ordinary acceptance of the term, but absolutely damp-proof. A vessel with sides only one-half inch thick stands in the offices of the Vibrocel Company in London. Not only does the vessel hold water, but it has stood full for months without a trace of dampness appearing on the outer surface. Another instance will suffice. A cell was built of vibrated concrete with walls two inches thick and three feet high, the diameter being seven feet. Within this cell another one with similar walls but of five feet diameter, was floated, sufficient water being put in to rise almost to the brim of the outer cell. In spite of the fact that the inner cell displaces nearly a ton of water, and that it has been floating so since May or June, 1913, no trace of dampness has appeared on the walls or bottom of the outer cell and only very slightly in one corner of the inner one. Little more need be said regarding the advantages of vibration than to record, in passing, the results of certain tests made by the well-known testing engineers, Messrs. David Kirkaldy & Sons. These tests bring out the surprising fact that vibrated concrete has about double the compressive strength of concrete which has been rammed in the ordinary way.

Description	Weight	Dimensions	Base Area	Total stress	Stress per sq. in.	Remarks
Mark 8.2.0 No. 1	16.78	Cube of Concrete rammed in ordinary manner	35.70	80150	2245	Mixture 1½ pts. granite (hippings ½" mesh)
Mark 8.2.0 No. 2	17.74	Cube of Concrete vibrated	35.94	161800	4502	1½ pts. sand. 1 pt. cement
R.	17.05	5.92x6.00x5.99	36.00	71400	1983	Age—6 weeks
Rammed R.	16.11	6.14x6.01x5.99	36.06	53650	1488	Tests made April 20/10
R.	17.22	6.14x6.02x6.01	36.18	70920	1900	Mixture 2 pts. sand from Thames
X.	18.11	6.06x6.00x6.00	36.00	134900	3747	ballast (¾" mesh)
"Vibrated" X.	17.83	6.01x6.01x5.99	36.00	123900	3442	1 pt. fine sand. 1 pt. cement
X.	18.00	6.03x6.00x6.00	36.00	119400	3317	Age—46 days, tests made March 27/13

These tests speak for themselves, and it only remains to point out that the substitution of vibration for ramming or spading solves the problem of placing concrete in narrow forms among complicated reinforcement. There is not the slightest risk of displacing the steel, and a better adhesion is obtained.

Having now explained the advantages of vibrating concrete, I will proceed with a description of the Vibrocel cellular system, which is made economically possible by the vibrating process. To quote from one of the Vibrocel Company's publications (to which we are also indebted for the records of tests and other data): "The cellular construction is advocated for the reason that it can be shown that it is the cheapest possible way of making cyclopean masses of concrete in almost unlimited size and strength for various purposes, the cost of which, carried out by the present method of block building is in many cases too great to allow the required work to be undertaken. The hexagonal form of cell has been chosen, this, as is well known, being the strongest. It would be tedious to go into an analysis of the stresses on this form, as well as unnecessary for our present purpose, but it can be shown that when a hexagonal cell or series of cells of that form is subjected to external pressure, there are no tensile stresses—all the cell walls are in compression. This is a point of some importance, as, when using vibrated concrete, it is practicable to build reinforced cell walls as thin as 2 inches, the steel, while being theoretically unnecessary, firmly tying together the whole series of cells; in other words, as much compressive strength is developed in a wall of vibrated

concrete only 2 inches thick as would be obtained in a wall 4 inches in thickness built of rammed concrete. Thus there is a saving of fifty per cent. in the amount of rich concrete used for cell building simply by the use of vibration."

The economy of the method may now be seen. It is possible to build up, as a series of hollow cells, a complete shell of the proposed structure, using for the thin cell walls a rather rich, fine-grained concrete. These walls carry a continuous reinforcement of expanded metal throughout the structure and, in addition, steel bars are embedded in the cells, forming a series of triangles with them and extending to the outer walls. These hollow cells are then filled with a lean mixture of concrete containing plums, or in some parts of the structure gravel alone may be used, the cell walls supplying all strength necessary. The coarse, cheap material is thus in a proportion of about 10 to 1 of the rich reinforced concrete. Thus we have weight and solidity, and at the same time continuous steel reinforcement throughout the mass—a very desirable combination, especially in subaqueous work.

Before going on to describe the construction methods used, it will be as well to mention at once the features of this system, viz., the fact that the hollow cellular construction of waterproof concrete gives the builder power to erect his structure in large sections (minus the filling), afloat in a sheltered position, or

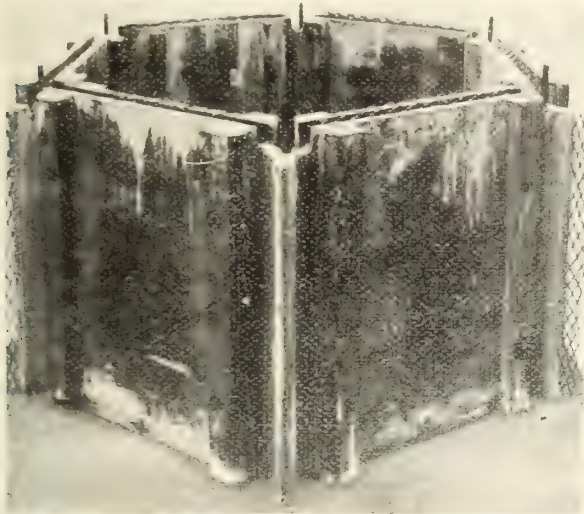
near his base of supplies, then to tow them out to positions where they can be sunk instantaneously by blowing out the cell bottoms with embedded cart-ridges after the section has been lowered to within a foot or two of the previously prepared bottom, by admitting water.

It would be impossible within the limits of an article like this to go fully into the actual details of the operation briefly described above. Enough has been said to show that it is not only possible but practicable to build bridge piers, quay walls, docks, etc., without the usual expenditure for coffer-dams, temporary piers or expensive form work, and also without any heavy machinery whatever, save that required for dredging, which would be the same in any system of construction.

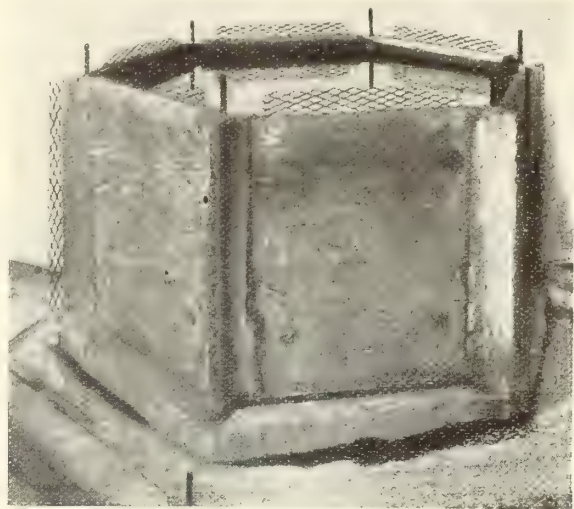
Before closing, a few words as to constructional details and costs will be of interest. Quoting once more from the publication referred to: "The construction generally is commenced by forming a concrete floor with upstanding dowels at the points where the walls forming the cells unite. On these dowels are placed pillars 3 feet high, made of vibrated concrete, each carrying 3 wings of reinforcement which overlap with the wings of the adjoining pillars and are embedded in the walls. To every pair of pillars so placed are bolted wooden shutters (or forms) forming the moulds in which the concrete walls, 3 feet high, are cast, embedding the contained reinforcement. During the operation of filling the space between the shutters with concrete, the patent pneumatic vibrators (hammers) are applied to the shuttering. The reinforcement be-

fore mentioned stands up a few inches above the tops of the walls, and will be included in the next tier of cells, also 3 feet high, making the reinforced concrete walls and pillars continuous throughout the structure. Dowels are placed in the tops of the pillars, and any desired height can be obtained by a repetition of the foregoing process, carried out in successive tiers of 3 feet at a time, resulting in continuous walls of concrete reinforced from bottom to top of the structure. In all this work no scaffolding whatever is required, the whole extent of the work being accessible by

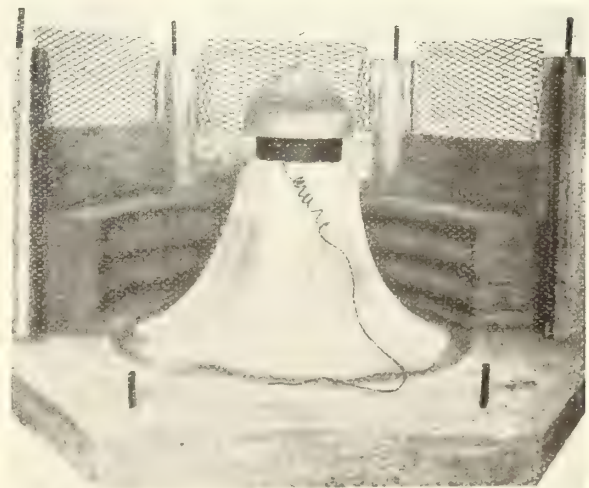
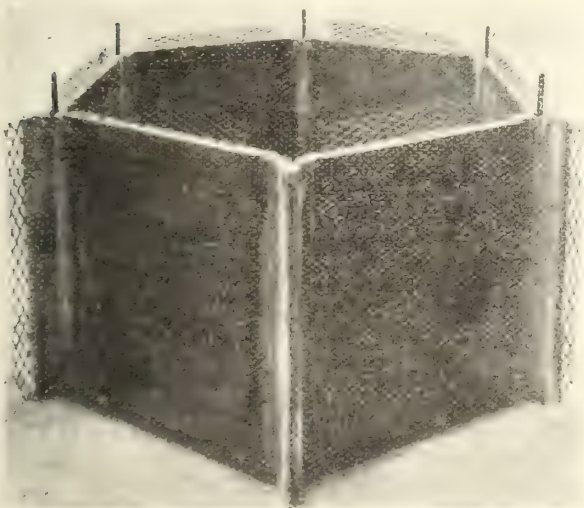
to reduce the cost. For example: (1) Roughly speaking 90 per cent. of the mass is of cheap, lean concrete, (2) No complicated form work is required, the forms used being simple square sections which can be used repeatedly. (3) The work is a continuous repetition of the same details, thus conducing to constantly increasing speed and cheapness of production. (3) As stated before, no heavy machinery or scaffolding is required. (5) No cofferdam or pumping is required, the cells being filled, after placing in position, with bagged concrete or by tremies. An estimate made by



Shutters in position ready for admission of concrete and its subsequent vibration.



Cell filled with water to demonstrate its non-porous character.



On the left—shuttering removed after filling with concrete, and vibration; on the right, method of construction of bottom of cell of floating unit of sea wall, with cartridge chamber and electric cable for blowing out bottoms of cells and instantaneously sinking the unit.

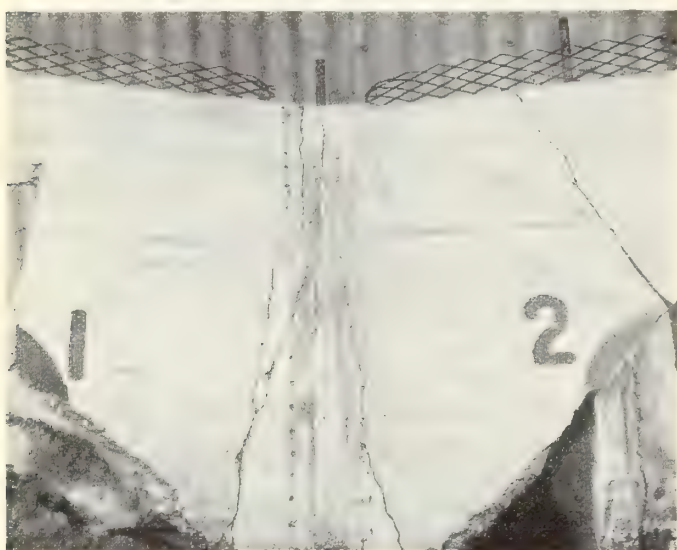
means of loose planks laid upon supports extending above the top of the shuttering.

No heavy machinery is necessary, and no single part of the work is too heavy for a couple of men to deal with. Among the many remarkable results of vibrating concrete "in situ" is the fact that, vibrated, the joint between old and new concrete is absolutely homogeneous. This latter statement, while given incidentally, is a very important one, and is well borne out by actual experiment. The reader will now be enquiring as to the cost of this method as compared with others. There are several factors which tend

the Vibrocel Company, based on English prices, and including profit and royalties, places the cost at 25/- a cubic yard, which applied to our western prices would work out at about \$9.00 a cubic yard—this, for completed work, including everything but excavation or dredging. Where gravel filling can be substituted for concrete in some of the cell sections, the cost can be further greatly reduced, sometimes working out as low as \$5.00 to \$6.00 a cubic yard, though it is only fair to say that in these cases there is a larger cross-section than would be used by ordinary methods. Making all allowances, however, one feels safe in say-

ing that a saving of 25 per cent., more or less, can easily be effected on the general run of works of this class, where permanent and solid construction is required—each problem, of course, being made a separate study and designed for the maximum economy.

It will be of interest to add that this system has been adopted by the Bombay Government for a large reclamation project in a location where the wall will be exposed to the full sweep of the Indian Ocean. Another instance of special interest, from the point of view of cost, is a coal dock in the Cape Verde Islands. In this case the owners of the property had only a certain amount of money at their disposal for construction purposes, and on account of all tenders being of a greater amount than this, had almost found it necessary to abandon the project when the Vibrocel method was proposed and found to come well within the figure set. The estimated cost for this latter work is something like 50c a square foot, a remarkably low



Cell burst by jacks, showing that vibrated the joint between the old and new concrete is absolutely homogeneous and that the lines of fracture nowhere coincide with the joints between the cell walls and pillar.

price for solid construction—due in part, probably to the cheapness of labor in the Islands. The attached drawing with diagram of estimated cost gives a good idea of the cost of one class of work under Western Canadian conditions. In other classes, such as dock or pier construction, it is probable that the reduction in cost over other systems would be even greater.

Digging Trenches and Holes in Frozen Ground

IN northern Minnesota, where the earth freezes to a depth of from 4 ft. to 5 ft. in winter and where consequently the cost of digging holes is high, the following expedient is used to keep down costs. When the top of the hole has been picked out to a depth of 6 ins. or more, a tin cup full of gasoline or coal oil is poured into the hole and lighted. The digging is then continued, the burning oil thawing the earth, and from time to time more oil is added. It is said that with the help of about a gallon of oil per hole, the cost of digging can be reduced approximately 15 per cent.

At the last annual meeting of the Iowa Engineering Society, Mr. Charles P. Chase described the use of lime

for thawing frozen earth preparatory to trenching. The ground was frozen to a depth of 4 ft., so that it could not be excavated with a trench machine. Lime was spread upon the ground along the line of the proposed trench and to its full width. The lime was broken into small pieces and covered with manure or straw. Hot water was then poured on to slack the lime and liberate the heat that thawed the ground sufficiently to enable the trench machine to dig it.

Steam jets have been successfully used for similar purposes. For example, in "Engineering News" for April 13, 1899, a description was given of a method used for thawing frozen ground in order to dig holes for electric light poles, from which the following information is abstracted.

A vertical jet pipe was connected by a tee to a horizontal pipe 24 in. long, capped at one end and connected at the other by nipples and four elbows with a pipe leading to the boiler of a traction engine. The nipples and elbows were provided to allow the necessary play for handling the appliance. To protect the workmen from the steam and to enable them to manipulate the jet pipe, two wooden handles 2 x 4 ins. in section and 10 ft. long were connected by stirrups to the two ends of the short horizontal pipe.

This jet pipe was forced down by two men pressing on the handles; as the earth thawed out, the steam carried the particles out alongside the pipe; and as the depth increased more steam would be condensed in the borehole until finally no steam escaped and the outflow was liquid mud. This outfit, which was invented by Mr. James W. Pearl, of Decatur, Mich., would thaw out about 30 holes for electric light poles in a day of ten hours.

In "Methods and Costs of Gravel and Placer Mining in Alaska," by C. W. Purington (U. S. Geol. Survey Bul. No. 263, 1905), various methods of thawing gravel for mining purposes were described substantially as follows:

According to experience in one district the efficiency of a good fire in creek ground was as follows: A fire taking three-fifths of a cord of wood (at \$12 a cord) is built against the face of the bank. The pile of wood is 18 ins. wide, 2 ft. high and 25 ft. long. Stones are laid up over the pile and a space is left to light the fire. The fire is lighted at 5 p.m. and left to burn until 8 a.m. the next day. The stones, which quickly get hot, are regarded as most efficient in thawing. On a 4 ft. thickness of pay gravel this amount of fire will thaw in the time specified from 5 to 6 cu. yds. This is at the rate of 9.2 cu. yds. thawed per cord of wood, which is considerably less efficient than the method of thawing with steam. Time, delays and awkwardness of the method, moreover, make wood fire thawing the most expensive that can be adopted. The figures per foot for shaft sinking range from \$3.16 to \$7.50 in taking gravel from prospect shafts.

The direct application of jets of dry steam to the gravel bank through the agency of driven pipes has been found to be the most efficient method in general practice for thawing frozen gravel. The amount of moisture contained in steam can be judged by the color of a jet of steam issuing from a small brass petcock. If it is transparent or whitish near the orifice it contains less than 2 per cent. of moisture. If pure white the moisture is above 2 per cent. A $\frac{3}{4}$ -in. steam hose is run from the boiler to the bank, where it ends in a manifold to which several $\frac{1}{2}$ -in. hose lines can be coupled. Each of these small lines ends in a hollow bar

about 5 ft. long with a tool steel point which is driven into the gravel and enables the jet of steam to penetrate far into the interior of the frozen mass.

In creek claims exceeding 15 ft. in depth, where solidly frozen ground occurs, the method of drifting with the use of the steam point is as follows:

A 20 h.p. boiler, capable of running 10 steam points, is put on the ground, and frequently one or two extra long points are provided for sinking holes. These long points, from 10 to 12 ft. in length, are not so strongly made as the 5-ft. points used in the drifting operations. In some cases pieces of $\frac{1}{2}$ -in. hydraulic pipe are used. The point is set up on the ground and steam or hot water is turned on. The time for sinking a hole by this method to bedrock is from 24 to 48 hours. If large flat stones are encountered in the gravel it is sometimes advisable to use strong, specially made points to prevent breaking. The average radius of a vertical shaft thus thawed by a single point is 2 ft. and the hole when cleared out has a cylindrical or tube shape.

On some of the work the 5 ft. points are used in batteries of four points each. A mallet is used to drive the points into the bank, where they are left from 10 to 14 hours. Each point thaws a block of gravel averaging 6 ft. into the bank, 18 ins. on each side of the bank and 4 ft. high. The use of hot water turned into the hose for starting the points is considered good practice. The points must be driven carefully and slowly, and for ten points distributed along a face the average time needed is from one to three hours. The amount of steam required for each point has been found to vary in amount from 1 to 2 boiler horse-power. The amount of gravel which a point will thaw appears to vary with the length of the point, and this is regulated somewhat by the character of the gravel. The 5-ft. point has been found to be the most economical.

A typical case illustrating the efficiency of the points is the following: Points of Dawson manufacture, 5 ft. long, costing \$15 laid down, were used in manifolds of four. They were put in at distances of from 2 ft. 6 ins. to 3 ft. apart, and were started with hot water. It took three hours to drive them in. A 12 h.p. boiler supplied the steam for ten points, three-fourths of a cord of wood being burned while the thawing was done. In twelve hours the ten points thawed a block of gravel 30 ft. in length by 5 ft. high, 6 ft. into the bank or a total of 33.3 cu. yds. This is at the rate of 3.3 cu. yds. per point and 44.4 cu. yds. per cord of wood.—Engineering and Contracting.

Ten Rules to Eliminate Building Failures

FAILURES happen at times in all lines of construction work, but it is to be regretted that whenever concrete is involved in any way, the disaster becomes "another concrete failure." Steel, brick and timber construction fails, too, but, as for instance, in the Quebec bridge failure, it was not a "steel failure," but a "bridge failure," a failure in design or workmanship. Concrete, however, is in the spot light, and must carry the brunt of blame, as well as receive praise and admiration.

Failures can be, and should be, avoided, by proper, intelligent precautions and workman-like methods. The following 10 rules, by W. P. Anderson, are a valuable guide to better practice:

1.—All buildings should be designed by a competent engineer and erected by contractors with special experience in this line of work.

2.—In winter weather the sand and stone aggregate

entering into concrete should be heated before concreting. One good method of doing this is to blow steam into the pile of material.

3.—The water used in mixing should be warm but not hot. The temperature of the water should not be over 130 deg. Water above this temperature is harmful to the cement.

4.—Avoid concreting when the temperature is below 25 deg. or when there is any likelihood of a sudden drop in temperature.

5.—After concreting in cold weather cover the floors with straw.

6.—Keep salamanders going under the concrete work and enclose all openings around building so that the heat can be confined.

7.—Watch the shoring carefully during concreting, as occasionally an imperfect shore due to a knot or some other cause may be used which should be replaced immediately.

8.—Leave all shoring until concrete has thoroughly set. Form work may be removed much sooner than the shores and when this is done, care should be taken to wreck only a small section at one time before re-shoring. Where the weather is apt to be below freezing for several weeks at a time in the winter it is better to leave the beam bottoms under the beams so that the shores under the beams do not have to be removed at all when taking down the slab panels. The shores should never be removed until the concrete is so hard that it is impossible to drive a 10-d. nail into the concrete and there should be at least 30 das. when the temperature of the concrete is above 45 deg. before the shores are removed. This temperature, of course, can be obtained artificially if necessary.

9.—In re-shoring, care should be taken to put a cap at least 2 ft. long and 4 in. wide on top of the shore to distribute the load, and in the case of concrete and tile or similar construction, this cap should be so placed that it bears on one or more ribs and in no case should it bear entirely on the tile, for, in the latter case, the tile will crush and cause the supporting floor to fall.

10.—Care should be taken to place a sill under all shores and especially in case of a tile and joist or similar construction where thin concrete members occur, these sills should be so placed that they will distribute the load over the joints in a tile and joist construction.

An additional suggestion which Mr. Anderson makes is as follows:

No cement should be used until it has been tested for soundness and fineness and for tensile strength at 1 da., 7 das. and 28 das.—Concrete-Cement Age.

One of the numerous methods by which concrete blocks can be given a finished appearance is surfacing them with a sand blast. The surface cement is worn away by the sand; the block is given a polish, and the broken stone, of which it is partly composed, appears, thus giving the block something the appearance of a polished limestone breccia. A glance at any pavement, from which the surface cement has been worn away, will serve to convey a very rough idea of the appearance a sand-polished cement block presents. If the mixture has been made with proper care, the block can be given quite an effective-looking surface, and, so far as appearances go, it is infinitely superior to the ordinary concrete block. Its one disadvantage lies in the fact that surfacing by sand renders the block more liable to erosion.

Suggested Designs for Sewage Treatment Plants for Residences and Small Institutions

THE information given in this article is abstracted by Engineering and Contracting from a paper by Mr. Paul Hansen, Engineer of the Illinois State Water Survey. The article gives data on the cost of plumbing a house, on the design and operation of simple septic tanks, of a modi-

the cost of plumbing a house is given in the following tabulation, the figures given relating to a two-storey house with basement:

Soil pipe with necessary Y and T connections	\$15.00 to \$30.00
Two-set tubs for laundry	20.00 to 60.00
Kitchen sink with drain board	7.50 to 30.00
Bath tub	20.00 to 200.00
Wash basin for bath room	7.50 to 40.00
Closet	17.50 to 75.00
Necessary piping and faucets for hot and cold water, including hot water boiler	20.00 to 40.00

Looking at the matter in another way, complete house plumbing including bath tub, sink and laundry tubs of wood and zinc, wash basin of enameled iron, water closet of porcelain may be installed for \$200. Complete house plumbing including closet, wash basin and sink of porcelain and bath tub and laundry tub of enameled iron may be installed for \$300. The first represents cheap and somewhat flimsy construction; the latter first class and substantial construction.

Simple Septic Tank.—The simplest form of treatment device that may be used for a single house comprises merely a tank, capable of holding the sewage produced in a period of 24 hours or longer. Mr. Hansen suggests a tank of the following dimensions, to cost approximately \$30 with concrete roof and floor and brick walls: Inside plan, 2 x 8 ft.; depth of tank, 6 ft.; depth of sewage, 3 ft. 10 ins.; simple wooden baffle, 1 ft. 6 ins. from inlet, extending 12 ins. into sewage; lower end of 6-in. outlet tile, a 90 deg. bend, submerged 18 ins.; the tank bottom slopes to the center, and the sludge is withdrawn from a sump through an outlet by opening a shear valve. The costs given in this article are relative figures, especially applicable to average Illinois conditions.

The effluent from a tank of this character contains no coarse solids, is likely to be dark in appearance and upon close observation will be found to carry finely divided suspended particles. It may be discharged into a perennial stream of moderate size without producing objectionable conditions, but where no such stream is available some other method must be utilized. In a sandy or gravelly soil the liquid may best be disposed of by permitting it to flow into a system of open jointed tile drains placed at 1 ft. to 18 ins. below the surface of the ground. The tile drain may be made up of a 4-in. farm drain and should have a length of about 100 ft. for every member of the household. The character of soil may materially vary the amount of tile necessary. To get the best results the liquid should be applied to the tiles in the form of a dose discharged rapidly from a syphon within a few minutes once every 12 or 24 hours. This can be accomplished by building in conjunction with the tank a

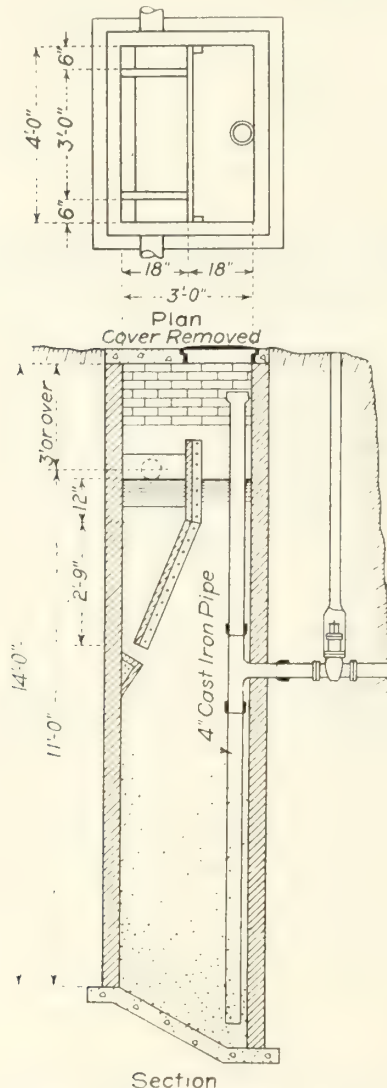


Fig. 1—Suggested design of modified Imhoff sewage tank for household of ten persons.

fied Imhoff tank adapted to the use of a household of ten persons, of a subsoil irrigation system, an intermittent sand filtration plant to handle the sewage from a household containing twenty-five persons, and a double contact filtration plant.

Cost of Plumbing.—An approximate estimate of

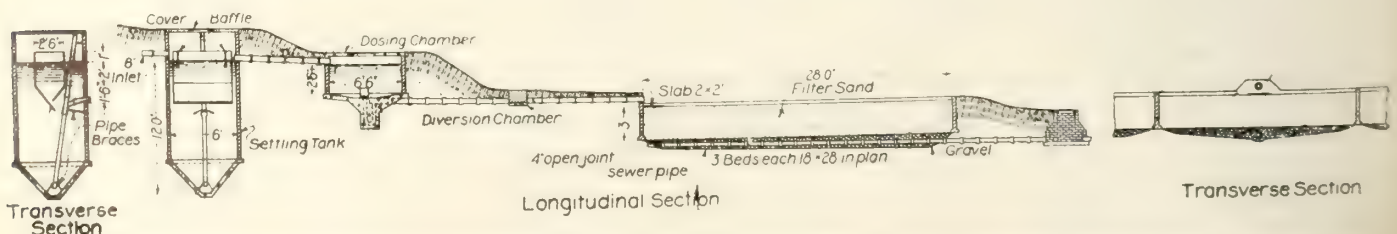


Fig. 2—Sectional elevations of a suggested intermittent sand filtration plant, with preliminary sedimentation, for treating sewage from household or institution of 25 persons.

small dosing chamber equipped with an automatic discharge syphon. Syphons are subject to derangements and may be omitted in favor of a more liberal use of tile. An arrangement for a sub-surface system of tile drains following passage through a septic tank is suggested by Mr. Hansen as follows:

Septic Tank, Dosing Chamber and Subsoil Irrigation

The septic tank is 2 x 6 ft. in plan and carries a depth of sewage of 4 ft. Its details are similar to those described above. The dosing chamber immediately adjoins the septic tank and is provided with an automatic siphon. After leaving the siphon the effluent passes into a system of drain tiles consisting of distribution and collector tiles, the former being from 12 to 18 ins. below the surface and the latter 1 ft.

carried to the outlet of the drain along with a sufficient quantity of water to render the liquid inoffensive.

In certain forms of clayey soil any attempt to cause the sewage to soak into the ground will prove futile, but this difficulty may be overcome by artificially placing beds of sandy or gravelly material about the tile. When this is done it is necessary to place sub-drains for carrying off the more or less purified liquid after it has passed through sand or gravel. This arrangement constitutes the principle of a well-known proprietary device for sewage treatment and can be counted upon to produce satisfactory results as long as a sufficient quantity of porous material is used. For large installations, however, it would prove costly and uneconomical.

It is difficult to lay down any hard and fast rules

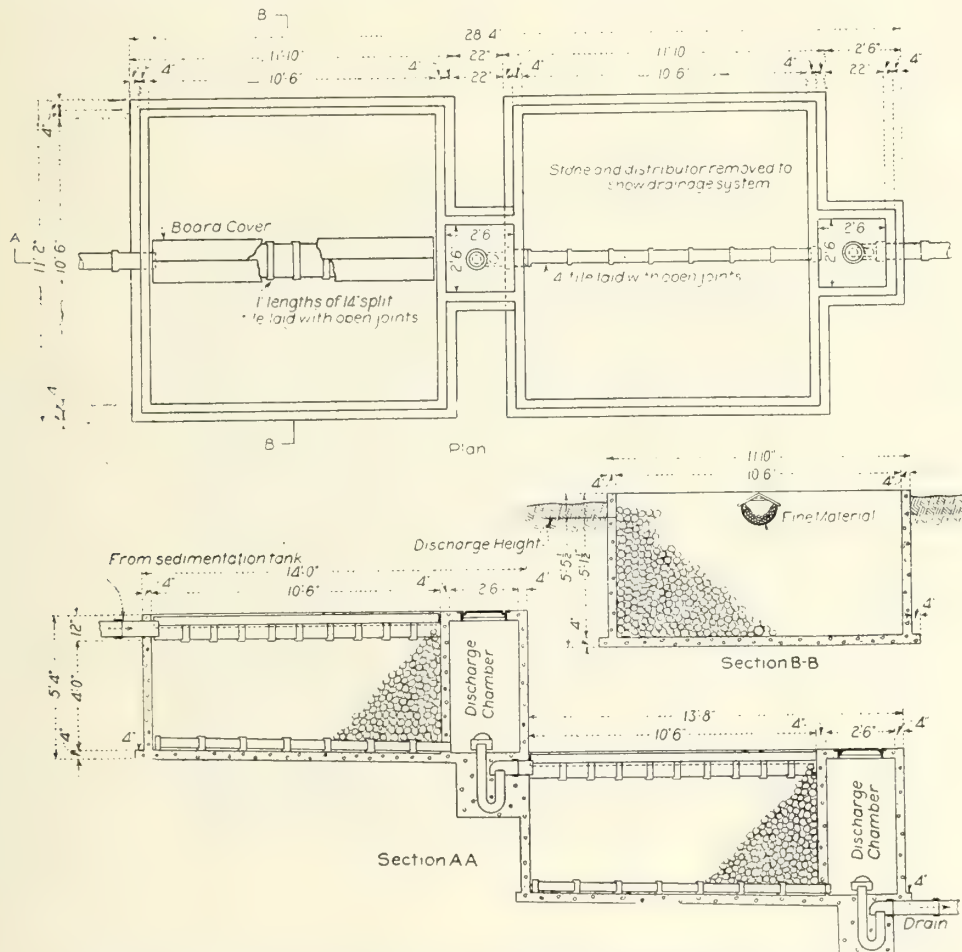


Fig. 3—Suggested design for double contact sewage treatment plant for large residences, country clubs or small institutions.

lower still and 5 ft. to one side of the distributor. The collector pipes may generally be omitted. Where the soil is of a finely divided character and capable of absorbing large quantities of moisture as is characteristic of most of the glacial drift the same system may be utilized, but can be relied upon adequately to take care of the sewage only during periods of small rainfall. This, however, often proves to be all that is needed for in wet weather the sewage may be discharged directly into a stream which will then have flow enough to provide the dilution necessary for inoffensive oxidation. Sufficient dilution may even obtain within the drain tile itself. It thus sometimes happens that the discharge of the effluent into the upper end of an existing long tile drain accomplishes all that is required, for in dry seasons the sewage will soak into the ground, while in wet seasons it will be

relative to the design and arrangement of subsurface sewage disposal systems. The proper length of drain tile, the necessity of collector drains and the desirability of surrounding the drains with porous material must under many conditions be determined by the method of cut and dry. Where the system is applicable, however, it is certainly the simplest, least offensive and easiest to maintain.

Modified Imhoff Tank for Residential Service

With certain forms of secondary sewage treatment devices, and often where sewage is to be discharged into a watercourse it is desirable to maintain the sewage in as fresh a condition as possible; that is to say, it is desirable to maintain the oxygen content of the sewage. To accomplish this Mr. Hansen suggests a modification of the Imhoff tank as shown in Fig. 1 herewith. As will be noted the tank utilizes a small com-

partment for sedimentation purposes and a lower compartment for the digestion of the solid matters. The solid matters which are settled out in the upper compartments gain access to the lower compartments through a narrow slot so trapped that the liquids in the two compartments may not readily intermingle. The sedimentation chamber must be made very much larger than is customary in connection with municipal sewage treatment works for the reason that the very uneven rate of sewage flow from an individual residence would subject the sedimentation compartment to violent disturbances. For this reason an average period of five to six hours sedimentation should be provided.

This tank has an advantage in that the sludge or solid matter is thoroughly digested and may periodically be discharged into some nearby depression without giving rise to objectionable odors. When dry it has the consistency of rich loamy earth and may advantageously be spread on lawns and gardens. The modification of the Imhoff tank here shown is adapted to the use of a household of ten persons. The cost of such a tank would be about \$60.

Intermittent Sand Filtration.—On large country estates or for isolated institutions such as alms houses, asylums, sanatoria, etc., perhaps the most economical and highly efficient system is so-called intermittent sand filtration. Figure 2 shows an intermittent sand filtration plant that will adequately care for the sewage of about 25 persons (generally they should not be built for populations of less than 25). The plant comprises also an Imhoff tank and a dosing chamber. The filters consist of a bed of sand 3 ft. in thickness, resting upon a carefully constructed under drain system of drain tile and a graded gravel. The total area of the installation is figured on the basis of one acre for every 750 persons tributary to the sewers. For a household of 25 persons there would be required 0.033 acres, or about 1,500 sq. ft. The sewage is applied to the filters intermittently and this is accomplished by a dosing chamber which is of such capacity that a single dose will cover one filter bed to a depth of 2 ins. The filter area should be divided into at least two beds, but preferably three. The latter arrangement permits one bed to be out of service for cleaning or repairs or for a protracted resting period without serious reduction in filter area and without interfering with the proper operation of other beds. The automatic dosing apparatus is so arranged that it will automatically discharge upon first one bed and the other and valve arrangements are such that any two beds may be maintained in service.

Intermittent sand filters will not operate without attention, and they should be visited at least once every few days to see that all parts are in proper working order and to keep the sand beds free from weeds. At greater intervals, perhaps once per month, it becomes necessary to take or scrape the sand lightly so as to break up the surface of the mat formed by the solid matter in the sewage, but with proper care this process should result in but very slight loss of sand. During the winter in cold climates it is necessary to furrow or mound sand beds in such a way as to cause the formation of a sheet of ice resting upon the top of the furrows. This will effectively prevent the freezing of the sewage as it passes along the troughs of the furrows underneath. The automatic dosing apparatus requires attention as already noted,

but with a well settled sewage and siphons of reliable make derangements will be infrequent.

Double Contact Beds.—A somewhat more extensive method of sewage treatment and one which is especially adaptable to very large farm houses, country clubs and institutions and for use in locations where the production of odors is not permissible is treatment in so-called contact beds. An installation comprising double contact beds is shown in Fig. 3. It is assumed that the contact treatment will be preceded by sedimentation. The contact beds are water-tight basins filled with gravel, broken stone, hard burned cinders, broken brick or any other material which presents a fairly rough surface and which is not easily disintegrated. The size of the material should not average less than $\frac{1}{2}$ in. in diameter or be greater than $1\frac{1}{2}$ ins. in diameter. Means are provided for permitting the sewage to flow into this bed and to fill the interstices of the material which it contains where it may remain in contact for a definite period of time. The bed is emptied and the period of contact is regulated by means of a time controlled siphon. In the design as shown in Fig. 3 the effluent from the first contact bed passes into another contact bed of exactly similar construction. Upon emerging from the second contact bed the liquid will be fairly clear in appearance and will have no offensive odor, thus rendering it suitable for discharge into a small watercourse. For the purpose of minimizing odors a specially constructed inlet arrangement to the bed is provided which prevents the sewage from being exposed to the atmosphere. The device consists simply of short half tile 14 to 18 ins. in diameter and laid with large open joints. Within the invert of this half tile is placed fine broken stone or gravel and over the top is placed a readily removable roof. The device also has another advantage in that it localizes all clogging in the fine material within the half tile. When this becomes clogged so that it will not readily permit the entrance of the sewage into the bed it may be easily removed and replaced with new material.

Reinforcing Cast-Iron with Concrete

The famous German expert, Dr. von Emperger, maintains that the engineering profession has lost during the fifty years reign of steel as a structural material the appreciation of the good qualities of cast-iron, in proof of which qualities he quotes a number of cast-iron bridges which have served well during many years. To this may well be added that only those cast-iron bridges survived which possessed the fewest imperfections of this material. The doctor also has something to say about the behavior of cast-iron reinforced by hooped concrete because in his system it is not the iron which reinforces the concrete, but on the contrary the concrete which strengthens the cast-iron. Briefly, in reinforced cast-iron the function of the hooped material is to maintain the hooped concrete in an elastic state and that of the concrete is to maintain the surface of the brittle metal under the hooping pressure and thus eliminate its brittleness. The duty of the hooping material is not to increase the resistance of the embedded cast-iron, but to make it more reliable by protecting it against brittleness. The hooping may, therefore, be made so much lighter than for the usual hooped concrete. It must, however, be dense enough to insure a perfect envelope to the cast iron.

Toronto Stock Exchange New Building

Successful Solution of the Problem of Adapting a New Structure to an Old—The Signalling and Annunciator Installations

IN several respects the new building opened recently for the Toronto Stock Exchange is a unique addition to the structural features of the city.

The building, which stands on a site to the west side of Bay Street, has a frontage of 70 ft. and a depth of 100 ft. It was the original intention of the members of the Exchange to erect a new building on a property 40 ft. x 110 ft., but later an opportunity was afforded to purchase the adjoining property to the south. It was felt desirable that provision should be made for future expansion, and while the Exchange members did not care to involve the expenditure of building a

complete new structure on the whole 70 ft. by 110 ft., it was considered feasible to tear off the front of the Fisher building, which comprised the 40 ft. of the lot, and alter this structure so as to conform with the requirements. The new facade across the complete frontage was therefore erected and the upper two storeys of the Fisher building were dropped back some 18 ft. in order to give the appearance of a complete new facade on Bay street. The problem in design resolved itself into joining the new building with the old structure, so that certain revenues might be obtained from the Fisher building section, and also that the Exchange might be enabled to use portions of the Fisher building in connection with their own business. As it was desirable that the main Exchange floor should be raised 6 ft. from the level of the street in order to secure privacy, a central entrance, devoted entirely to the use of the Exchange members, was provided. Two additional entrances, one for the office section of the new building, and one for the office section of the Fisher building, were made, thus giving three avenues of approach from Bay street.

As the floor levels in the Fisher building were determined, the problem in design was a difficult one, as a hard and fast rule as to proportions had to be followed. The difficulty of tying these different floors in proper levels of the new building arose, and it was also necessary to carry the parapet sufficiently high to mask the Fisher building section and give head room for a storey at this point. Provision has been made for possible expansion in the future by designing the steel in the main Exchange room in such a way that in the event of the tearing down of the Fisher building, the ceiling and skylights in the main room would form a symmetrical ceiling.

The new section of the Exchange is of Indiana limestone, and is of fireproof construction. Double steel doors at each connecting storey with the Fisher building are provided so as to minimize the risk of fire. The main entrance to the vestibule of the Exchange room proper is panelled in Jaune royal marble, to ceiling height. The floor is of grey Tennessee marble tile. On the left of the entrance vestibule is the members' cloak room, and a strangers' room on the right, together with toilet accommodation for the members. The main Exchange floor is 56 ft. x 42 ft. x 135 ft. in height. It is lighted through large win-

dows from the rear and also from a skylight in the centre. The walls are panelled to a height of 9 ft. 6 ins. with quarter-cut oak. At the east end of the building, up one storey in height, is the visitors' gallery; on the opposite end of the main floor is located the president's rostrum, and between the main Exchange floor and opening directly after it, is placed the members' lounge room.

The interior furnishings are in keeping with the other features of the building. The floor in the lounge room, main Exchange room and the secretary's office, is finished in cork tile. A pneumatic tube station is connected up with the printing office on the top floor of the Fisher building, with the telegraphers'

office in the basement, and also with certain brokers' offices in the front portion of the new building. Outside the accommodation already referred to, the remaining space of both new and old buildings is reserved for offices. The structure is heated by the "hot-blast" system, being brought in from a central heating plant. All air when it enters the building is first washed, then it is passed through heating coils and blown to the main Exchange floor; the balance of the building is heated by the "direct" system. This portion of the heating service is installed under the Webster vacuum type. All telegraph, telephone, ticker and annunciating wires run in metal conduits. Provision is made in all these services for possible expansion. The motor room for ticker service, pneumatic tube service, etc., are located in the basement, and at different points in the building, basement, and other floors, the necessary accommodation is provided.

The signalling and annunciator installations are interesting features of the building. This complicated equipment is modelled on that of the New York Stock



New Building for the Toronto Stock Exchange.

Exchange. The figures used on the annunciating board are said to be the largest in use in any Stock Exchange at the present time. The signal device is unique in that it automatically operates three "drops" simultaneously. Either from the private lines connecting with the private telephone in the Exchange or from the call board in the hall and telephone switchboard, these signals are so arranged that the member is able to determine whether the call comes from his own house, direct from the hall or from the switchboard. Provision is made for 60 telephones, but at present only about 35 have been installed. The lighting fixtures were supplied to special designs prepared and selected by the architect. Throughout the ladies' room, entrance hall, elevator halls, and Stock Exchange room, the furnishings are in statuary bronze, so as to harmonize with the other interior furnishings.

All the offices in the building are supplied with semi-indirect pendants fitted to moonstone reflectors finished in brushed brass. The remainder of the building is equipped with ceiling lights and steel high efficiency reflectors.

The architect was Mr. John M. Lyle, Toronto. The following were the contractors:—George Oakley & Son, cut stone; J. C. Scott Company, carpentry, etc.; Dominion Marble Company, marble; Rice, Green & Company, Limited, electric wiring and fixtures; Mr. F. C. Henderson, lighting fixtures; Fred Armstrong Company, Limited, plumbing, heating, and ventilating.

The Construction of Creosoted Wood-Block Pavements*

By R. S. Manley †

THE correct depth of concrete base or foundation varies with the soil conditions, but the materials and the methods of mixing are in such common use as to be standard and easily secured. We are interested principally in the construction placed on top of the concrete. The principal causes of defects of more or less serious nature are: 1. Irregular or uneven surface, due to careless laying, shifting of sand cushion, or breaking or settling of concrete; 2, expansion due to the entrance of water into the blocks either by way of the joints or from below.

An irregular or uneven surface is death to any paving material, because a depression in the surface holds water and repeated churning of wagon wheels in the depression are bound to cause an enlargement and deepening of the depression.

The concrete of the base should be mixed quite wet and finished smoothly with a flat wooden spreader which gives a surface practically as even and uniform as could be obtained by template. On this should be spread $\frac{1}{2}$ to 1 in. of clean sand, making the sand cushion conform to the contour of the finished street.

Then place the blocks quite close together, and roll thoroughly until a perfect surface with no inequalities has been obtained and until the blocks are firmly in place. It will require a great deal of rolling to accomplish this, but the end justifies the means. After this, fill all joints two-thirds full of hot bituminous filler of such melting point as is suited to climatic conditions, and spread a thin coating of sand. The use of the bituminous filler is most important. It converts the street into an effective watershed which without absorbing any of the water, directs it into storm sewers or other

drainage paths. Should any water remain on the surface, the wind and the sun will rapidly dissipate it.

This construction gives an even waterproofed surface. This surface cannot be worn by traffic because the pressure of wheels is even and regular and there is no dropping or jolting of wheels entering and leaving low spots. As the blocks are laid tightly, there is no wearing at the joints. There can be no change in the sand cushion as long as the surface remains intact, a solid sheet in fact of wood block cemented together by the filler. It is assumed that the concrete is sufficiently strong so that it will not break or settle.

Expansion difficulties are eliminated by the use of bituminous filler, for there can be no expansion without absorption of water, and no absorption of water when all rainfall is conducted quickly to drainage sewers. In addition to this it must be remembered that with bituminous filler each block is surrounded by an individual expansion joint.

Another method of construction is to provide a mixed sand and cement cushion, and sand-filled joints or interstices. This cushion does not give the opportunity for absolutely smooth surface that the sand cushion gives, and is considerably more costly. The sand filler in the joints allows moisture to be absorbed in the pavement and ultimately this moisture gets into the blocks and trouble ensues. It is only on sheets of extremely heavy traffic that sand can be used as a filler without some expansion difficulties sooner or later.

It can be stated without fear of successful contradiction that every sand-filled pavement in the south has at one time or other given trouble from uncompensated expansion, and with equal confidence it can be stated that not one bituminous filled pavement has given trouble from this cause.

There have been objections put forward to the bituminous filler because of the belief that it would produce a sticky surface, disagreeable in warm weather. But if the proper filler is secured, and it is correctly applied there can be no such objection. The suitable filler has a consistency of rubber and can be taken in the fingers, bent and twisted without soiling the fingers. In applying this filler a spreader with squeegee attachment places the filler in the joints where it is needed, and not on the surface of the blocks where it is not needed.

It is proper also to use less creosote oil per cubic foot of timber when bituminous filler is used, for the primary function of the creosote oil in this case is to preserve against decay instead of trying to make the creosote oil fill the double purpose of preservative and absolute waterproofer. No one familiar with preservative methods and history will question the efficacy of 16 lb. of creosote oil per cu. ft. in preserving against decay for an indefinite period.

The method of construction may be summarized as follows: Provide adequate smooth concrete foundation, use enough sand to cover any inequalities in the concrete or depth of blocks (except in railway areas and on grades, when use sand and cement mixed), lay blocks tightly, roll until smooth, fill joints with bituminous filler, spread coating of sand, and turn on the traffic.

On the ground of cheapness of construction, it is almost always better to put curtain walls in after the frame is up; the work then goes ahead much faster. Weather-tight joints can readily be made, and the joints between the frame, that is, the columns and floors, can be concealed so that no unsightly crack is visible.

*Abstract of a paper read at the annual meeting of the American Wood Preservers' Association, at New Orleans.

†Creosoted Wood Block Paving Co., New Orleans, La.

The New President of the Canadian Society of Civil Engineers

THE election of Mr. Matthew Joseph Butler, LL.B., C.M.G., to the highest office in the gift of Canada's leading engineering organization was recorded in our issue of February 4, which contained a report of the last annual meeting of the Canadian Society of Civil Engineers.

Mr. Butler differs from many of his predecessors in office in that he has reversed an established principle.

It has generally been the case when a man has succeeded to the position in the Canadian Society which Mr. Butler now holds, that he has come into prominence; that the Society has shed lustre upon him. Mr. Butler came into prominence years ago. For more than a decade he has been prominently in the eye of the constructional public in Canada. It is he who sheds lustre upon the Society. We say this not to the disparagement of the many excellent men who have preceded Mr. Butler in the presidential chair of the Canadian Society, but rather to emphasize the fact that Mr. Butler has been trained under the public eye and that he is essentially the kind of man who should play a dominating part in the development of the profession with which he is identified.

The chief offices held by Mr. Butler were enumerated in one of the closing paragraphs of the leading editorial article published in our issue of February 4:—"The Society is to be congratulated upon Mr. Butler's succession to its presidency. As a former chief engineer of the Department of Railways and Canals, later Chairman of the Board of Management of the Canadian Government Railways, later again General Manager of the Dominion Steel Corporation, and now the executive head of the firm of Messrs. Armstrong, Whitworth of Canada, Limited, Mr. Butler has a long experience, and a breadth of vision gained therefrom, which cannot but be of inestimable value in the Society's work."

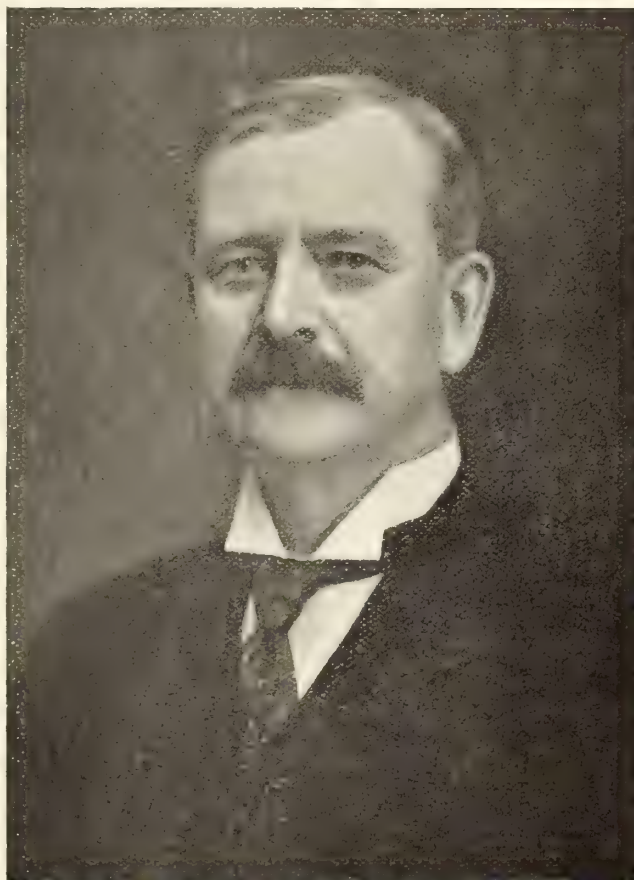
Mr. Butler's career has been a most diversified one and it is impossible in an article of readable dimensions to enumerate all of his various professional connections. Starting at the very beginning, before he had decided upon making engineering his life work, we find that he was born in Deseronto, Ont., in 1856, his parents being Tobias Butler, of the County of Wexford, Ireland, and Elizabeth McVey, of the

County of Antrim, Ireland. Educated in the public schools and at the De La Salle Institute, Toronto, he proceeded to the University of Toronto and took what then constituted the "course" in civil engineering, which consisted of mathematics, science, English, French and German, scattered over the four years of the Arts course. At that time engineering proper was not taught in the University. In 1878 he was admitted both an Ontario and Dominion land surveyor.

In 1895—bridging over a number of years during which he was engaged in various engineering and industrial enterprises—we find that he graduated in law at Chicago. He was admitted to the Illinois Bar in June, 1897. For some time he was engaged with Mr. M. J. Haney, the contractor for the Hillsborough bridge. In 1904 he was appointed Assistant Chief Engineer of the National Transcontinental Railway and the following year became Chief Engineer of the Department of Railways and Canals, to which in 1909 was added the position of Chairman of the Board of Management of Canadian Government Railways. He resigned in February, 1910, to become Second Vice-President and General Manager of the Dominion Iron & Steel Company and the Dominion Coal Company. This brings us down to modern times, which are covered in the extract from our previous article quoted above.

The new president of the Canadian Society is a man of wide interests and one who has extended experience in Society work. His connection with both the American Society of Civil Engineers and the Institution of Civil Engineers (Great Britain) ante-dates his membership in the Canadian Society. He is a member of the American Society of Mechanical Engineers, the American Geographical Society and the Royal Astronomical Society of Canada.

It will be seen, then, even from the above brief, that the record of President Butler embraces phases of life; engineering and otherwise, which have not come within the experience of the average municipal or railway engineer who has attained the coveted honor in the Canadian Society. We make no apology for reiterating our belief that this long experience and breadth of vision, called into play on behalf of the interests of the Society, will make for greater development than has been in evidence in the immediate past.



Mr. M. J. Butler, LL.B., C.M.G., Montreal.

Credit Foncier Building, Vancouver

CONSIDERABLE progress has been in evidence during the past month in connection with the construction of the Credit Foncier ten-storey office building in Vancouver, one of the most substantial structures of its type at the Coast. The building occupies a central position at the corner of Hastings and Hornby streets, and is of reinforced concrete construction, with cut stone and terra cotta for the exterior facing, the whole being surmounted by a copper cornice. In the interior the floors will all be finished with rock maple. Marble wainscoting and terrazzo floors will be placed in the corridors. All the offices, with the exception of those to be occupied by the Credit Foncier, will be finished in oak. Mahogany will be used in finishing the quarters of the Credit



The ten-storey Credit Foncier Building now under construction at Vancouver.

Foncier. The Durham system of plumbing is to be installed throughout the entire building, and three passenger elevators will be at the service of the tenants. One of these elevators will be geared to carry 5,000 pounds weight. The plans for this building were prepared by Messrs. H. L. Stevens & Company, Vancouver, in co-operation with Messrs. Barrott, Blockader & Webster, architects, of Montreal. Construction work is being carried on by H. L. Stevens.

The city of Ottawa, Ont., will replace the present wooden structure over the Rideau River on the boundary between the municipality and the township of Gloucester, with a new steel bridge 389½ ft. long. This bridge will be of a heavy through plate girder construction and will be made up of five spans each about 78 ft. long. It will have a 48-ft. roadway and two 6-ft. cantilever sidewalks, and will carry two electric car tracks. The roadway is carried on a 4½-in. reinforced concrete slab, supporting a 4-in. creosoted wood block wearing surface placed on a 1-in. sand cushion, drainage being effected by a camber of 6 ins. at the crown of the road-

way and seep holes placed at the centre of each panel about 2 ft. from each main guide. Sidewalks are formed with a 3-in. reinforced concrete slab with the cement finish, with a slight slope outwards sufficient to drain. The piers and abutments will be constructed of a 1:3:6 concrete. The four piers and the south abutment will be carried down to rock. Test borings have shown that rock will be met at from 10 ft. at the abutment to 15 ft. at the north pier, below normal water level. The north abutment will be piled, concrete being taken down 10 ft. below water level; borings show rock at this point to be about 25 ft. below water level. The city having only a 60-ft. right-of-way at the north approach it was necessary to build a U abutment, keeping it as closely as possible on city property. The south abutment, however, is built with wing walls. Traffic will be maintained during the erection of the new bridge by a temporary structure placed about 100 ft. east of the present bridge. Designs for the sub-structure and super-structure were carried out under the direction of Mr. Archibald Currie, City Engineer, Ottawa, Ont.

Concreting in Winter

SOME useful hints on the handling of concrete in freezing weather are given in a paper by Mr. L. C. Wason from which the following is abstracted: "The aggregates must be free from frost when mixed. A live steam pipe can be shoved into the sand pile, the escaping steam heating it and removing all frost. The same may be done with the stone, but a canvas should be thrown over the top of the pile to retain the heat which more readily escapes. Where a considerable amount of heating is provided for in advance, steam pipes are laid on the ground, and stone as received is dumped upon them. Then there is a canvas thrown over to prevent storms getting into the pile, and to retain the heat. The frost is thus easily and economically removed.

"Salt is frequently used in the water to lower its freezing point. It is seldom worth while to heat the water itself. Little care need be used to prevent mass concrete from freezing, as the frost will usually only strike to a depth of about one inch. Buildings are enclosed with tarpaulin tied onto an outside staging, and the enclosed space is heated with salamanders burning coke. Sometimes it is possible to use steam.

"Frost is removed from form work by the use of salt and steam, and if the concrete surface is left rough it is common to sprinkle the top surface with salt to prevent freezing. In winter it is very common to put the finish on as a separate operation, after building is enclosed, and not as an integral part of the construction, on account of the danger of freezing. When it is put on, it must be kept from freezing for the first forty-eight hours.

"The expense of protection against the weather is not very great, and good results can be so surely guaranteed that it is not usual for the writer ever to discontinue work on account of cold weather.

"Occasionally it is necessary to make some provision for the protection of the men. Shelters or wind-shields are built in front of the benches where carpenters are making up forms, as well as around the men at the concrete mixer, whose work does not necessarily keep them warm. Where excavation is going on in the open air it is expedient to have a building with a good fire where the men can warm themselves when necessary; and on a few jobs it has proved to be wise to furnish hot coffee free in these shelters."

New Vancouver Car Barn of the B. C. E. R.

THE British Columbia Electric Railway Company has recently placed in service at Vancouver a new car barn. At the present time the company has a barn in the centre of the city and another in the Mount Pleasant section. The new car barn is located in the western portion of the city, the company thus having barns distributed at several points, enabling it to arrange economically for the operation of early and late cars as well as provide quickly for special service in any section of the city.

The new barn is 400 feet long by 52 feet wide and will accommodate 64 of the company's city cars. In the construction of the car barn the entire site was excavated to a depth of 4 feet 8 inches below the street level. The excavation was then covered with a concrete floor 6 inches thick, and concrete walls 9 inches thick were built up to the street level. The floor from each wall has a slope of one inch in six feet towards the centre line, thus providing good drainage. For one of the tracks a jackpit three feet deep and one foot wide extends over 200 feet of track, this being the only break in the concrete floor. Upon this concrete base, along the line of each track, 12 by 12 inch posts were placed at 8-foot centres. These posts supported 12 by 12 inch stringers upon which the rails are laid at the street level. In this way easy access is possible in all parts of the barn to the under side of the cars.

The subgrade was generally hardpan, but in some places where the base material was not so good additional sills were placed under each of the 12 by 12 foot posts. At the present time the walls above the street level are boarded with 2¾ inch shiplap, on which is placed galvanized iron. This form of construction is followed as it is expected in the future to build other units, possibly all of reinforced concrete type, at the same place. The shiplap boarding will then act as one side of the form for the reinforced concrete wall. The roof truss is of wood construction and is of simple type, the roof of the building being also of galvanized iron, with wired glass skylights every 32 feet. The building is generally lighted by 100 watt metal filament lamps, so arranged as to provide one lamp to each 192 square feet of floor area. The timber construction supporting the rails is completely wired, sockets being placed here and there for use in repair work. The building is equipped with a complete sprinkler system for fire protection, as well as with fire monitors, mounted on towers, just outside the building. These towers are about 20 feet high and support 6-inch stand pipes. The monitors have a range of 70 feet with a 2½ inch nozzle and the towers are placed 50 feet apart. The building is also equipped with a complete low pressure steam heating plant.

The car barn was built according to plans prepared by the company's architect and erected by day labor.

Vancouver Builders' Exchange—Annual Banquet

OPTIMISM was the prevailing keynote in the speeches at the first annual banquet of the members of the Vancouver Builders' Exchange held in the Elysium Hotel. Mayor Baxter and other speakers reviewed the period of stress through which those engaged in all branches of industrial activity in Vancouver had been passing in common with business men in all parts of the world and expressed the sanguine opinion that the chastening process would rebound to the ultimate good of the city and all concerned.

His Worship dwelt in reminiscent vein with the evolution of the city from a hamlet to its present proportions, alluding with pride to the fact that Vancouver was now entitled to take rank as the fourth city in importance in the

Dominion. Touching on the financial stringency which has obtained during the past few months the Mayor deprecated the tendency to pessimism and pointed out that the change in conditions was causing business men to concentrate their efforts towards building up an industrial community—a change which would undoubtedly result in the establishment of affairs on a much more stable basis than previously existed.

Mr. W. M. Horie, the newly-elected first vice-president, acted as toast-master. Mr. Wm. O'Neil proposed the toast of the city and its executive, His Worship responding. The toast to the Board of Trade was proposed by Mr. E. G. Baines, Secretary W. A. Blair replying. Mr. J. L. Skene, the president, proposed the toast to the architects, Mr. W. M. Dodd, vice-president of the Society of Architects, and Mr. J. D. Beatson, honorary-secretary of the Society of Architects, responding. Mr. T. J. Madlen proposed the toast to the civic Board of Works, which was acknowledged by Ald. Hepburn. The city departments was proposed by Mr. D. H. Wilkie and replied to by Mr. S. M. Jarrett, building inspector, and Mr. J. G. Morgan, plumbing inspector. Mr. Booker proposed the toast to the press.

The following officers were elected at the previous meeting of the organization: President, Mr. J. L. Skene; first vice-president, Mr. W. M. Horie; second vice-president, Mr. T. J. Madlen; directors, Messrs. T. G. Bird, J. O. Perfect, T. Borgford, A. E. Lee, T. P. Morehead, D. H. Wilkie, J. G. Anderson, J. R. Wartman, H. N. Boulton, E. G. Cullen, W. M. O'Neil, A. P. Bogardus, P. E. Ritchie and J. M. Douglas.

Reports were submitted by the president and the secretary, Mr. H. H. Lindsay, outlining the work since the Builders' Exchange was formed and dealing with the questions which would be taken up during the current year. Among the latter are proposals that joint conferences be held between representatives of the organization and the city authorities with a view to securing a revision of the building by-laws. The question of examining and issuing licenses to building inspectors, superintendents of buildings and clerks of works will also be advanced. It was stated in the secretary's report that it was the intention of the executive to considerably extend the scope of the exchange during the ensuing year.

The thirtieth annual meeting of the Connecticut Society of Civil Engineers was held last week at Hartford, Conn.

The forty-sixth annual convention of the American Society of Civil Engineers will be held in Baltimore, Md., early in June. The sessions will be held at the headquarters of the Engineers' Club, Baltimore.

The late Mr. Thos. M. McLeod, who died last month in Toronto, was a native of Georgetown, P.E.I., and a graduate of McGill University. He was only forty-six years of age at the time of his death. For several years he had been engaged in large excavating and reinforced concrete works in New York City and vicinity. In the operations which he had been carrying on for the city of Toronto he was associated with Mr. Ogden Merrill, of New York City. The late Mr. McLeod was highly esteemed on account of his geniality and unswerving integrity.

The members of the Toronto Builders' Exchange at a largely-attended meeting on February 9, Mr. Bulley, president, in the chair, decided unanimously to remove their headquarters to a flat on the fourth floor of the recently-erected building on the corner of Simcoe and Richmond streets for the Goodyear Tire & Rubber Company. The removal will take place about March 1.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The estimates of the Works Department in the city of Toronto for 1914 total more than \$5,000,000.

The Essex, Ont., County Council, who have been considering road improvements estimated to cost \$1,000,000, have postponed further consideration of the project until later in the year.

The annual convention of the Ontario Good Roads Association will open on February 24 and run over February 25 and 26. It will be held in the York County Building, Adelaide street, Toronto.

Tenders for the steel pipe in connection with Ottawa's eight-million-dollar water supply system have been extended to February 20. The bids will remain unopened until after a new plebiscite is taken.

Contracts, reported elsewhere in this issue, have been awarded for gas works estimated to cost \$500,000, for the Ottawa Gas Company, Ottawa, Ont., for whom Messrs. Merrifield & Burnett, Toronto, are the engineers.

At Hamilton, tenders are about to be called for a steam plant to cost \$3,500,000 to be erected by the Dominion Power & Transmission Company, according to plans prepared by Messrs. Prack & Perrine, 36 St. James street, Hamilton.

Plans have been prepared, by the Montreal Electric Commission, for conduits on a number of main streets in the business section, and for St. Lawrence Boulevard, from Ontario street to the river. Tenders will be called for this work early in the spring. The conduits are for power and other cables, and will involve the doing away of poles.

The Canada Machinery Corporation, Limited, has been reorganized on a comprehensive and satisfactory basis. Enterprising plans were formulated at a meeting of the bondholders at Galt last week. The company foresees renewed activity and increased prosperity, not merely in view of general conditions but also having regard to its own immediate financial concerns as now arranged for.

The National Brick Company, Montreal, will reopen their plants at Laprairie, P.Q., on the 20th inst., with a production of 300,000 bricks per day. The plants have been closed down since the end of November. The outlook for Montreal brick companies is more bright than it was last year, when there was overproduction. There is almost certain to be very extensive building of residences and flats, which are in greater demand than supply.

The Montreal Board of Control is now considering the largest and most expensive annual programme of public works ever undertaken in the city. The total reaches over five million dollars and includes the laying of twenty miles of permanent pavements in the down-town district and extensive macadamizing in the outside wards. This will cost \$1,500,000. Expenditure of \$1,091,000 is earmarked for sidewalks, \$1,700,000 for sewers, and \$760,000 for the aqueduct.

The Quebec Builders' Exchange held their annual banquet at the Victoria Hotel recently with Mr. C. E. Morissette, President of the Exchange, in the chair. The function was attended by the Mayor and many other local officials, as

well as by Mr. R. P. Lemay, on behalf of the Architects' Association. Mr. E. T. Nesbitt, who is well-known as one of those intimately identified with the development of the building trade in Canada during the last few years, congratulated those present upon the regulations governing building construction now in force in Quebec.

A large programme of public works to be carried out during the summer has been prepared by Mr. G. Janin, engineer to the city of Montreal, who has now practically recovered from his recent illness. The programme will entail the outlay of \$5,000,000 and provides for the laying of about twenty miles of permanent pavements in the centre of the city and a large amount of macadamizing in the outside wards, an expenditure of \$1,091,000 for sidewalks, \$1,700,000 for sewers, and \$760,000 for the aqueduct. A sum of \$100,000 will be put aside for repairs to certain streets.

Under the Quebec Government Bill, the Montreal Parks Commission has been given enlarged powers. The city is authorized to advance sums of money to the commission for the preparation of a general plan of improvements for the Island of Montreal. The cost of carrying out the improvements as contained in the plan is to be paid by the municipalities interested in the work, but the commission must not execute any part of the plan without having obtained the consent of the municipalities, or if they refuse, authorization of the legislature must be secured. The cost is to be met by a special tax imposed by the municipalities.

An attack has been made on Messrs. Lea, Jamieson, and Hackle, the engineers employed by the city of Montreal to report on the break in the water conduit. The allegation was that these gentlemen were connected in a direct or indirect way with the Cook Construction Company, who are carrying out the contract for enlarging the aqueduct, which work, it was asserted, was in a measure responsible for the accident to the conduit. Messrs. Lea, Jamieson, and Heckle have written to the Controllers, stating: "No member of this engineering board has now, or has ever had, any connection whatsoever, directly or indirectly, with the Cook Construction Company, or any member of the said company, or of any other company that has carried out work for the City of Montreal on the water-works, intake or conduit, or enlargement of the aqueduct." The Ambursen Hydraulic Construction Company of Canada, Limited, of which Mr. G. R. Heckle is manager, have also written denying any connection with the Cook Construction Company.

WESTERN CANADA

Edmonton, Alta., is to have an isolation hospital at a cost of \$350,000 if the ratepayers approve of the by-law which is to be submitted on March 10.

The sum of \$570,000 is to be spent on main sewers and outfalls at New Westminster, B.C., where Mr. J. W. B. Blackman is the city engineer.

The Canada Cement Company's plant at Exshaw, Alta., was destroyed by fire last week. It is stated that the fire will necessitate closing the plant until the buildings are reconstructed, although the company have such a large stock of

cement on hand that it will not interfere with their business. The Calgary plant, which was closed, will be started immediately and will be kept in operation until the reconstruction of the Exshaw plant has been completed.

A tunnel sewer at an estimated cost of \$900,000 is an item included in the estimates for the city of Edmonton, Alta. Mr. A. J. Latornell is the city engineer.

At Calgary, Alta., Mr. A. Pirie, a local architect, is completing plans for an Industrial Housing Building, estimated to cost \$250,000. The building will be of six storeys and basement. Excavating is to start at once.

Tenders for four viaducts, estimated to cost \$540,000, will close at Vancouver on March 4th. These structures will span the G. N. cut at Hastings, Pender, Keefer and Harris streets. Individual and collective tenders are invited.

The city council of Regina, Sask., has accepted the proposal of Messrs. Coste & McAuley, of Calgary, to supply gas at the city limits and the ratepayers will be asked to vote on a by-law to raise in round figures \$4,700,000 for the installation of a system.

At Kindersley, Sask., surveys are being made for a reservoir estimated to cost \$125,000. The construction will include earth and concrete dams about 4 ft. high and 1,000 ft. long, also $2\frac{1}{2}$ miles of steel pipe and an installation of low pressure electric pumping machinery.

Sir John Jackson Company, Limited, contractors for the new breakwater at Ogden Point, B.C., have arranged for the first shipment of granite blocks from Nelson Island to form the base of the concrete structure which will be placed in position as soon as more settled weather prevails.

The Estevan, Sask., Board of Trade has two propositions in mind with a view to investigating the possible supply of oil and gas at Estevan. One is that the town undertake the sinking of a deep bore at the expense of the ratepayers. The other is that the citizens form a stock company and do the work by private enterprise, receiving by way of security a franchise from the town.

The Alaska Railway Bill directing the president to purchase and construct 1,000 miles of railway in Alaska at a cost not to exceed \$40,000,000 has passed the United States senate by a majority of 46 votes to 16. The bill places upon the president the responsibility for the selection of the route from tidewater to the interior of Alaska, and the construction, equipment and operation or leasing of such lines as he may construct or purchase to constitute this route.

A company, to be known as the Vancouver Railway and Ocean Terminal Company, is seeking incorporation by special act of Parliament to build a line about three miles in length across the city of Vancouver. The railway would be on the south side of False Creek, designed to connect the joint False Creek terminal with deep water frontage and wharves, which it is proposed to erect at Kitsilano reserve, in connection with an improvement scheme under the harbor commission.

The Saskatchewan Presbytery, Regina, is still working on the proposition to erect a \$1,000,000 denominational college and the site and grants for this institution have been secured. It is expected that some arrangement will be made for the erection of the college during 1914. The Roman Catholics of Regina also have in view the erection of a college. This college was to have been commenced last year, but it is believed that it is to be considered during the present year.

The Dominion Government will contract for the erection of a substantial armory at Regina during the present year. It is understood that this building will cost in the neighborhood of \$200,000 to \$250,000, although provision is

only made for the expenditure of \$75,000 during the present year in the estimates. The government has also announced its intention of the erection of two other substantial buildings at Regina at a cost of \$75,000 each. One of these will be a customs building.

The Canadian Pacific Railway are building a line from Golden, B.C., to Fort Steele, having acquired the Kootenay Central, which was abandoned, after 12 miles had been built. Trains are operating from Golden south as far as Spillimachee, while steel has been laid much farther and grading is progressing far ahead of the steel. Work is being urged north from Fort Steele to Golden. This will bring the miners of the rich Windermere silver-lead district within a range of 250 miles of the large custom smelters and within but a few miles of Trail, B.C., where most of the silver-lead smelting is done.

The new structure known as the P. O'Sullivan Building, just completed in Calgary, is claimed to be the record in rapid construction work in that part of Western Canada, having only taken seventy days to complete. It is three storeys in height, with a full-sized basement, the latter being of reinforced concrete, the upper storeys having fireproof walls. A marble front gives the store a striking appearance, the hall and staircase leading to the upper flats being finished in the same style. The back of the structure is built of red glazed brick, while the side walls are of hollow tile. Mr. J. Henderson is the architect and Messrs. McDougall & Forster are the contractors.

Mr. T. R. Cornick, contracting engineer, Vancouver, was recently awarded an important contract covering the erection of 43 miles of wooden pole transmission line for the city of Kamloops, between the city's hydro-electric generating station on Barriere river and the sub-station in Kamloops. The contract calls for the use of 45-foot wooden poles with steel core aluminum conductors, equivalent to No. 4, B & S. gauge solid copper. Spans will average 200 feet. This will be a 45,000-volt line, using pin type insulation manufactured by the Locke Insulator Company. The line will carry a ground wire at the peak, and one metallic telephone circuit. Messrs. Duncane, Dutcher & Company, Vancouver, are the consulting engineers for the city of Kamloops in connection with the extensive scheme of hydro-electric development, of which this work will form a part.

Interesting figures have been prepared by the advising engineers connected with the Burrard Peninsula (Vancouver) Joint Sewerage Commission for the apportionment of the cost of the work to be executed or to be taken over by the commission during the current year. It is proposed in a more or less tentative way, depending on the sale of bonds by the commission, to undertake more than \$1,500,000 worth of new trunk sewer construction, which with engineering expenses and the amounts payable to the city of Vancouver and Point Grey for sewers already built will bring the proposed expenditure of the board up to \$1,645,000 for the season. The programme of work for the year, which has already been started is confined at present to the China creek and Canoe creek districts, serving ward eight of the city, the north end of South Vancouver and the Cedar Cottage district. Several branches radiate through the district and finally combine to make the proposed Clark drive sewer, emptying into Burrard Inlet. The estimated cost of these items is: Knight road and Canoe creek extensions, \$249,600; Clark drive outfall, \$319,000; extension of Main street trunk to Central Park, \$354,200; Gladstone branch, \$40,700; Earl's road branch, \$15,400; Main street branch, \$154,200; engineering, \$78,000; total \$1,256,700. Included in this figure is also the cost of an investigation advised by Engineers Rust and Thomson in reporting to the government when the act was passed last August. The cost will be \$45,000.

Important Constructional Projects at St. John, N.B.

Correspondence of the Contract Record

THE citizens of St. John are congratulating themselves upon the success of the commission plan of government, which St. John was the first city in Canada to adopt. After a two years' trial, with civic affairs administered by five commissioners, each the head of a department, devoting all his time to the city's business, the results show a decided improvement over the old irresponsible system, with a mayor and board of aldermen, most of the latter being elected to represent different wards and several elected at large. The city's treasury department has just issued its annual statement, which shows that there was a considerable unexpended balance in every department at the end of the year, the whole amount totalling \$105,000, of which amount \$50,000 was devoted to the relief of this year's assessment, \$25,000 to retire some bonds, \$18,000 to improve the water distribution service and the balance for other public purposes. While the debt of the city is shown to be a little over \$5,100,000, the assets exceed this sum by \$2,575,000, and the city controller in his report was able to say:—"The city's financial position the past year was certainly a very easy one compared with the majority of other cities in Canada." The present city council during its two years in office has done a good deal of permanent street paving, improved the street lighting in the business centre and extended the water distribution service.

To Enlarge the Dry Dock

The plans for the dry dock at Courtenay Bay provide for a dock only 900 feet in length. The Board of Trade is now taking up with the government the question of increasing the length to 1,150 feet, so that this dock would be as large as any to be constructed in Canada during the next few years. Norton Griffiths & Company are also suggesting that the wharves which they are to construct at Courtenay Bay be built of concrete, and this matter is being taken up with the government at Ottawa. Mr. Norton Griffiths has assured the Board of Trade that his whole contract, including the dredging of Courtenay Bay, the wharves, the breakwater and dry dock will be completed well within the contract time, and to this end the Norton Griffiths Company has taken over all the work from the sub-contractors, and will itself make provision for speeding up the work of construction on the whole contract.

Hon. S. O. Bigney, of Attleboro, Mass., is in St. John to form a company to take over the Canadian patents and manufacture in this city a new type of suspenders which are now being manufactured in Attleboro for the American market. If the company is organized, it will mean the employment of a large number of operatives and add another to the many lines of goods turned out from factories in St. John. T. McAvity & Sons hope to be in a position to let the contract for their big iron and brass manufacturing plant early in the spring.

The city of St. John owns a large area of land desirably located in the adjoining parish of Lancaster. During the past year there has been much talk over a proposal to have a part of this area divided into lots upon which cottages would be erected for working men. The city council has given the matter a good deal of consideration, and last week the Mayor was given authority to bring an expert from Montreal to make a survey of the lands and suggest a town development plan, following which some action would be taken to offer a means of relieving the congestion of population in the growing city. This property is located near West St. John, but the extension of the street car service is a guarantee that there will also be development this

year at East St. John, where considerable building was in progress last year.

The Maritime Dredging & Construction Company has been awarded the contract to construct 2,240 linear feet of new wharves at West St. John. This is the contract begun by Connelly & Charleson. The new company has just given an order for 5,000,000 feet of hard pine timber and has taken over the contracts from the old firm for 8,000,000 feet of hemlock and 1,500,000 feet of hard wood, which is now being got out in the forests of New Brunswick. The E. G. M. Cape Company, who are building the big sugar refinery, have been given the sub-contract to construct the concrete face and surface of the new wharves and will soon assemble a large plant for that purpose. The timber cribs which will form the sub-structure of these wharves must be of great depth, as they must extend over thirty feet below low water and provide also for a rise of tide of twenty feet. This contract is to be rushed to completion as rapidly as possible, so that at least two steamship berths may be available for next winter.

The St. John city council will ask the provincial legislature to enact a law which will provide that the property owners on streets which it is proposed to provide with permanent pavement shall pay one-half the cost. In some Canadian and many United States cities the property owners must pay the total cost, and in some the proportion ranges from 50 to 100 per cent. Under the present law in St. John, the property owners on any street may have it paved on agreeing to pay half the cost, but one-third of the property owners can block the improvements; and the council is asking authority to go ahead unless 60 per cent. of the property owners protest. All the street paving that was done last year was done on the basis of half payment by the property owners and half by the city; but the provision in the law enabling one-third of the former to block progress, prevented the council from carrying out as extensive a programme as it had planned. There is a good deal of opposition to the proposed change, and it is said this will be carried to the legislature by those who contend that the whole city should be assessed for all street paving. Whether the new law is adopted or not, the growing demand of the citizens for street improvement will ensure a continuation of the permanent paving policy which has been carried out for the last two years.

The steel frame of the new post-office has now been erected to the height of three storeys. The steel frame of another of sugar refinery buildings has been erected, and rapid progress is being made by the contractors. T. McAvity & Sons, in asking the city council to fix the taxation on their new iron and brass manufacturing plant at \$5,000 a year for forty years, stated that there would be an initial expenditure of \$300,000, and that when the whole group of sixteen buildings was assembled on the new site it would represent an expenditure of about \$2,000,000. Their plans have been completed and they are ready to begin construction work early in the spring.

The federal government has provided in the estimates brought down at Ottawa recently for an expenditure of more than \$3,500,000 in public works at St. John, including harbor works, the new post-office, breakwater, a spur line of railway to Courtney Bay and other important works. There is so much general construction work in sight that this promises to be even a busier year than last in and about St. John. Norton Griffiths, M.P., was recently in the city making arrangements to take over the sub-contracts for Courtenay Bay work and have them carried on by the Norton Griffiths Company. It is announced that more dredges will be brought to Courtenay Bay and that the work on the great breakwater and dry dock will be accelerated with a view to the completion of the whole contract within two years.

The railways department at Ottawa has asked the city

for the plans of two new wharves which the city is asking the government to build, just above the wharf of the sugar refinery. A railway trestle with a draw, to permit the passage of schooners, now crosses the area, and it would be necessary to divert the railway and dredge out the basin in order to provide deep water wharves. If the government decides to carry out this work, it will greatly increase the wharf accommodation where it is much needed on the eastern side of the harbor.

Personal

Mr. H. L. Fitzsimmons, building inspector for the city of Prince Albert, Sask., has resigned.

Mr. George D. Mackie, of Swift Current, Sask., has been appointed City Engineer and Commissioner at Moose Jaw.

Mr. Charles H. Keefer, of Ottawa, has been elected to the directorate of the American Society of Civil Engineers.

Mr. Angus Smith, the newly appointed City Engineer of Prince Albert, has taken up his duties in the Saskatchewan city.

Mr. D. W. Johnson has been appointed engineer to the municipality of South Saanich, B.C., at a salary of \$3,000 a year.

Mr. J. Jonsson is Acting City Engineer of Saskatoon pending the appointment of a successor to Mr. George T. Clark.

Mr. T. Aird Murray, consulting engineer, Lumsden Building, Toronto, is removing to fresh quarters at 186 King Street West, Toronto.

Mr. W. G. Chace, Chief Engineer of the Greater Winnipeg Water District, addressed a meeting of the University of Manitoba Engineering Society last week.

Mr. J. H. Haffa, architect, has opened an office at 209 Peterkin Building, Toronto. Mr. Haffa has been associated for the last three years with Mr. J. A. Harvey, 165 Bay St.

The Edmonton Engineering Society held a meeting on February 5, when Mr. J. M. Bogg, Assistant City Engineer, delivered an interesting paper, entitled, "The Tunnel Sewers of Edmonton."

Mr. Franklin Remington, of the Foundation Company, is the new president of the General Contractors' Association of which Mr. C. A. Crane, 51 Chambers Street, New York City, is the secretary.

Col. A. J. Van Nostrand has been elected President of the Engineers' Club of Toronto. The First Vice-President is Mr. Chas. H. Heys, the second, Mr. W. A. Bucke, and third, Mr. E. L. Cousins.

Mr. Geoffry C. Ommanney has been appointed special engineer to Sir T. Shaughnessy, president of the C. P. R. Mr. Ommanney was appointed resident engineer in Montreal for the C. P. R. in 1908.

Mr. Arthur V. Ruggles, who was at one time employed by Messrs. Hazen & Whipple, a New York consulting firm well known in Canada, has been appointed Assistant Engineer of the Water Filtration Bureau of the city of Cleveland, Ohio.

On February 9th Mr. H. W. Durham, Chief Engineer in Charge of Highways, Borough of Manhattan, New York City, delivered an illustrated lecture on "The Highways of Panama," before the Graduate Students in Highway Engineering at Columbia University.

Mr. F. J. Robinson, Regina, formerly Deputy Minister of Public Works, has been appointed Chairman of the Highways Commission of Saskatchewan in succession to Mr. A. J. McPherson, who has been promoted to the Chairmanship of the Government Finance Commission.

In our report of the Canadian National Clay Products

Association published in our issue of February 4, we misspelled the name of Professor Edward Orton, Jr., of the Ohio State University of Columbus, Ohio, who gave an interesting address on the subject of Ceramic Schools. We are indebted to the Dunn Wire-Cut-Lug Brick Company, of Conneaut, Ohio, for the correction.

Mr. F. W. Cowie, engineer of the Montreal Harbor Commissioners, is in Europe, visiting various ports. Mr. Cowie will examine the developments carried on at London and other British ports, and will also investigate methods at Marseilles, Genoa, Hamburg and Antwerp. A paper on Montreal Harbor will be read by Mr. Cowie at a meeting in London of the Institute of Civil Engineers.

Dr. Wm. A. Parks, Professor of Mineralogy in the University of Toronto, recently delivered an interesting lecture in the Physics Building of the University on "The Building Stones of Eastern Canada." The lecturer gave a review of the chief building stones in Ontario, Quebec and the Maritime Provinces. He spoke at length on the possibilities of marble and granite in Canada, of which he said there was an excellent supply. He expressed the opinion that the future of building in Canada depended on the production and use of these classes of stone over those of the more common kinds. Cement, he explained, was largely replacing the ordinary kinds of stone, as was shown by the fact that most of the quarries not producing marble or granite were lying idle at present.

American Road Builders' Association— New Officers

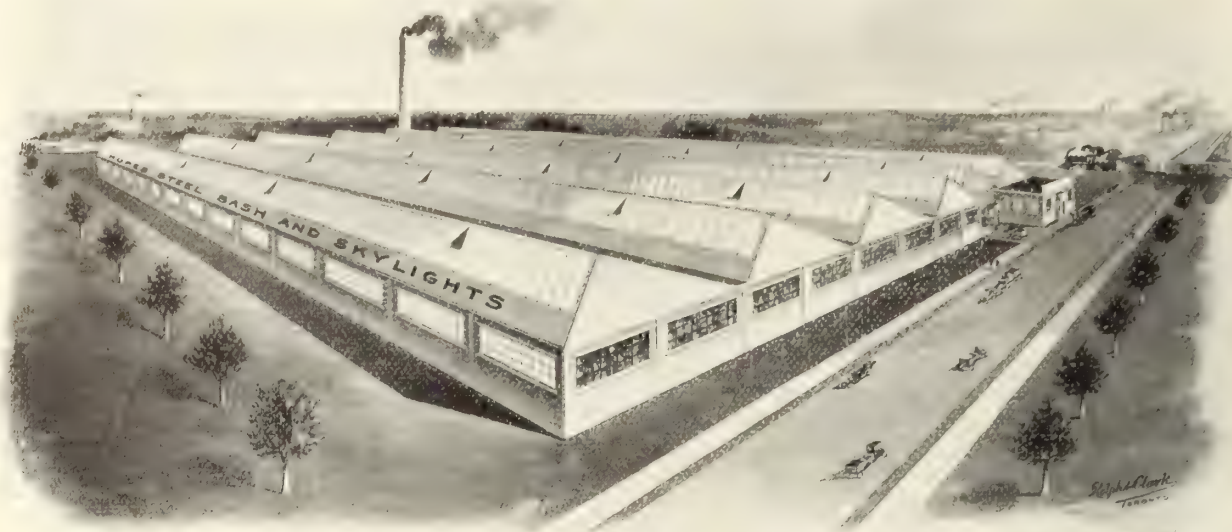
The annual meeting of the American Road Builders' Association for the election of officers was held at the Hotel Astor, New York, N.Y., February 6. The following officers and directors were elected:—President, Mr. W. A. McLean, Commissioner, Department of Public Works, Toronto, Ont.; First Vice-President, Mr. Geo. W. Tillson, Consulting Engineer, Borough of Brooklyn, N.Y.; Second Vice-President; Mr. A. W. Dean, Chief Engineer, Massachusetts Highway Commission, Boston, Mass.; Third Vice-President, Mr. A. B. Fletcher, Highway Engineer, California Highway Commission, Sacramento, Cal.; Secretary, Mr. E. L. Powers, Editor "Good Roads," New York, N.Y.; Treasurer, Mr. W. W. Crosby, Consulting Engineer, Baltimore, Md.

Directors for Three Years

Mr. Samuel Hill, President, Washington State Good Roads Association, Seattle, Wash.; Mr. Paul D. Sargent, Chief Engineer, State Highway Commission of Maine, Augusta, Me.; Mr. A. H. Blanchard, Professor of Highway Engineering, Columbia University, New York, N.Y.; Mr. R. H. Gillespie, Chief Engineer of Highways, Borough of the Bronx, New York, N.Y.; Mr. Harold Parker, Ex-Chairman, Massachusetts Highway Commission, Worcester, Mass.; Mr. Fred E. Ellis, Manager, Essex Trap Rock & Construction Company, Peabody, Mass.

The reports of the Executive Committee, the Secretary and the Treasurer were presented. These showed a large gain in the active membership of the Association, while the financial condition was found to be very satisfactory. Altogether the work of the Association during the past year has been the most gratifying in the history of the organization.

The Frontenac Floor and Wall Tile Company have just completed a factory at Kingston, Ont., for the manufacture of interior sanitary tile for floors and walls. The factory has been built with Canadian capital and is operated by Canadian labor. It is a one-storey building, of brick and steel construction, well lighted on the four sides. The machinery equipment is of the very latest type. The factory has the advantage of good shipping facilities, it being located at the



New factory at Peterborough, Ont., of Messrs. Henry Hope & Sons of Canada, Limited.

junction of the C. P. R. and G. T. R. main line, in close proximity to water routes through the Great Lakes. The R. D. Farnham Company, 911 New Birks Building, Montreal, are the sales agents. The company manufacture tiles of every description, including art panels and decorative tile, mantel tile, and also floor and wall tile. In addition they handle mantels and andirons in copper, hammered brass and wrought iron in a variety of designs and finishes.

Prince Albert Builders' Exchange—Annual Meeting

At the annual meeting of the Prince Albert Builders' Exchange, the following officers were elected for the ensuing year: President, Mr. A. W. Knox; Vice-President, Mr. G. A. Meyers; Secretary, Mr. John R. Davidson; Treasurer, Mr. G. B. Mitchell; Auditor, Mr. R. Stevenson. Directors:—Messrs. A. P. Andersen, G. E. Winter, H. W. Davy and Jacob Thompson. Mr. H. W. Davy was delegated to attend as a representative of the local exchange at the annual convention of Builders' Exchanges held in Moose Jaw on February 16. The report of President Knox and Treasurer Mitchell showed that the financial condition of the organization was most satisfactory despite the recent hard times. The secretary, Mr. John R. Davidson, gave a review of building operations during 1913, making a forecast of greater activity during 1914. According to Mr. Davidson's report, the Prince Albert Exchange is developing steadily and before long will become an important factor in the local building situation. Among the matters which are engaging the attention of the Exchange may be mentioned, employers' liability and state insurance; the wage clause; wages of carpenters and bricklayers; the hours of various trades, and the duty on stone and cement. An interesting feature of the latter part of 1913 was the inauguration of lectures given by prominent business men of the city. The first of these addresses was given by Mr. J. Melrose Morrison, architect, and the second by Mr. H. L. Fitzsimmons, city building inspector. Both of these lectures were well attended and much instructive information was given. The officers and members of the Prince Albert Exchange are united in the aim of making the present year one of unprecedented achievement.

An Up-to-date Steel Sash Factory

BY the end of the month the new Hope factory in Peterborough will be ready for business. This plant is said to be the finest of its kind in America. The building is all brick and steel and shows well the adaptability of Hope's steel sash and saw-tooth roof to the modern factory. The Hope people's claim of "Daylight factories" is remarkably demonstrated in their own plant. The factory is 200 ft. long and 180 ft. wide. We are told by Mr. Young, the vice-president and manager of the company, that the machinery for this plant has all been specially designed for them and embodies the very latest improvements in steel sash machinery. They claim that their method of straightening their sash bars by hydraulic pressure is one of the great achievements in steel sash manufacture and is superior in that the bars are not distorted in any way and make an absolutely plumb sash. The factory is fitted throughout with steel carrying tracks and travelling cranes and apparently is a perfectly equipped steel sash plant. The Hope announcement and photograph of their factory is shown on page 35.

The Herbert Morris Crane & Hoist Company, Limited, Toronto, are associated with Herbert Morris Limited, the English firm who have just received from the London and North Western Railway Company an order for ten 10-ton hand overhead travelling cranes and two electric cranes. This, together with an order for eight 12-ton hand cranes, from the London and South Western Railway Company, makes the largest contract of the kind that has been placed for some years past.

A particularly interesting trade publication is "A history of the trade-mark, Yale," received from the Yale & Towne Manufacturing Company, New York. The booklet contains a record of cases in which the company's rights have been sustained. It is prefaced by a sketch of the origin of Yale products. This prefatory part contains many illustrations of interest to those concerned with this line of manufacture. It is pointed out that the benefit of the trade-mark accrues not only to the manufacturer, but to the public and the consumer in establishing and identifying an article of assured quality.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Athabasca, Alta.

The Town Clerk is considering certain extensions to the waterworks system which include filtration system and reservoir, and also additions to the distributing system. Estimated cost \$35,000.

Brantford, Ont.

The city council has under consideration the laying of sanitary sewers on Winnett, Simpson, Patricia, Norwich, Merrell, Lewis, John, Grant, Grand and Edwin Sts., Braund, House, Wade and Wells Aves., at an estimated cost of \$25,000.

Tenders will be received by Chairman Board of Works, Ald. Geo. Ward, until noon Feb. 19th, for the supply of sewer pipe required by the city during 1914. Specifications, etc., at the office of the engineer, T. Harry Jones.

Brockville, Ont.

The installation of an intercepting tile pipe sewer system, at an estimated cost of \$10,000, is under consideration by the town council, and the laying of sidewalks on certain streets is contemplated.

The laying of macadam roadway, at a cost of \$15,000, is being considered by the town council, who are also discussing the question of the waterworks system.

Canora, Sask.

Tenders for water system, estimated to cost \$200,000, will probably be called in March. Water is to be brought from Crystal Lake, a distance of 14½ miles; 12 in. wood pipe will be used for watermain; syphon under river bed to be crossed. Sewerage and watermains in the town will make an additional 1½ or 2 miles. Engineers, Chipman and Power, Mail Bldg., Toronto.

East Oxford, Ont.

Tenders will be received by F. G. Jackson, Oxford Centre, until Feb. 21, for 4,252 ft. drain, 4 catch basins and a concrete wall. Plans, etc., at office of Engineer, F. J. Ure, Woodstock.

Edmonton, Alta.

The sum of \$137,240 has been included in the city estimates for a filtration plant.

The following by-laws will be submitted to the ratepayers in the near future, \$2,164,196 for extensions to the sewerage system; \$1,125,300 for extensions to the water mains; \$75,000 for the purchase of water meters, and \$19,200 for the purchase of hydrants.

Guelph, Ont.

The city council is considering the purchase of sewer pipe, cement and paving bricks. Further information can be obtained from City Engineer, E. J. Holland.

Gloucester Twp., Ont.

The Twp. Council has under consideration the construction of a drainage system to draw the water overflow off Findlay Creek.

Hamilton, Ont.

The city council has under consideration the laying of asphalt pavements on Prospect, Tuckett, Caroline, Vine and McNab Sts., Leinster, Balsam, Connaught, Flatt, Victoria and Balmoral Aves; and asphalt and wood block pavements on Aberdeen Ave., Herkimer, Queen and Main Sts.

The construction of a steam auxiliary pumping plant in connection with each waterworks system is under consideration by Board of Control.

The construction of an overflow sewer, at a cost of \$8,260, in connection with the West End Disposal Plant has been passed by the Committee, and will be submitted to the city council.

The Canadian Sealer & Clay Products Co. has purchased a site of 58 acres, and will manufacture sewer pipe and all kinds of clay products. Modern sewer pipe plant is to be installed and probably a wire cut brick plant. Information can be obtained from J. H. Salter, c/o Lewis & Arrel, Federal Life Bldg.

Kindersley, Sask.

The town council is considering the construction of a reservoir for which surveys are being made. The proposed capacity is about 1,000,000,000 gallons. The erection of an earth and concrete dam about 40 ft. high and 1,000 ft., 2½ miles steel pipe and installation of low pressure electric pumping machinery, will be necessary. The estimated cost of the project is \$125,000.

Kingston, Ont.

Tenders will be received by Deputy Minister Dept. of Naval Service, G. J. Desbarats, Ottawa, until noon Feb. 28, for the installation of a bored pipe-well at the Govt. Radiotelegraph Station Kingston. Specifications, etc., at office of Gen. Supt. of the Radiotelegraph Service, Dept. Naval Service, Ottawa, or at Kingston.

London, Ont.

The City Council is about to purchase 45,000 paving bricks and 125,000 gals. road oil.

Tenders will be called in March by the City Council for the construction of 12 in. to 42 in. concrete pipe storm water sewers.

The city council will call tenders in March for the construction of a sanitary brick sewer and disposal plant, at an estimated cost of \$75,000.

Medicine Hat, Alta.

The sum of \$25,000 has been included in the city estimates for improvements to parks and boulevards.

New Westminster, B.C.

Tenders will be called by the city council in about a month for the construction of main sewers and outfalls, at an estimated cost of \$570,000.

Ottawa, Ont.

Chas. Hopewell, Clemow Ave., and others, are interested in a movement for the construction of a highway from the city to Prescott. The Board of Control is to be approached on the question of debenture issue.

The City Council is considering the paving of Bridge St. and Bank St. between the Canal and Rideau River, but the material to be used is not yet decided upon.

Tenders will be received by the Chairman of the Waterworks Com., City Hall, until 4 p.m. Feb. 24th, for the supply of lead pipe and piglead. Specifications, etc., at office of Engineer and MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Tenders will be received by the Chairman of the Board of Control until 4 p.m. Feb. 24th, for the supply of broken stone District "A," 8,650 tons; Dis. "B," 8,650 tons; District "C," 20,350 tons; District "D," 16,250 tons. Specifications, etc., at offices of Engineer and MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Point Edward, Ont.

Tenders received by the Town Clerk, John F. O'Neil, until 8 p.m., Feb. 28th, for the supply of material and construction of (a) labor and laying of approximately 4,000 ft. 6-in. pipe; 10,000 ft. 4-in. pipe, with valves, hydrants, etc. (b) Furnishing cast iron or steel water pipes and specials. (c) Furnishing valves, hydrants, cocks, lead pipe, etc. Plans, etc., at offices of H. A. McLean, Engineer, Room 5, Town Hall, Sarnia, and office of Contract Record, 220 King St. W., Toronto.

Revelstoke, B.C.

The government has granted \$16,500 towards completing the motor road to Mt. Revelstoke and making a park on its summit.

Sydney, N.S.

Tenders will be received by D. M. Curry, Clerk to the City Council, for 15,000 ft. water pipe.

Toronto, Ont.

The sum of \$125,000 was included in the estimates for the establishment of an asphalt plant.

Tenders will be received by the chairman of the Board of Control until March 3rd for the construction of sewers on 31 streets. Plans, etc., are at the office of the Commissioner of Works.

The estimates include new supply main in North Toronto, at a cost of \$525,000, and extension high pressure fire zone, \$500,000.

The Commr. of Works, R. C. Harris.

has recommended the following work, the estimated cost of which is as specified:—Bitulithic pavements, Balsam Rd., \$4,250; Beech Ave., \$6,397; Quebec Ave., \$23,664; Woodville Ave., macadam, \$9,708; Gerrard St. E., brick block, \$10,890; Queen's Park Cres., asphaltic concrete, \$29,059; Oakwood St., asphalt, \$1,471; Tennis Cres., asphalt, \$2,309; Gerrard St. E., asphalt, \$39,516; Inkerman St., asphalt, \$1,605; Frichot St., brick block, \$2,884. Street grading:—Hemlock Ave., \$5,865; Maughan Cres., \$3,695; Sparkhill Ave., \$2,280; Willard, \$2,279; Evans, \$1,160; St. Clements, \$12,256. Also construction of walks on 15 streets, and concrete curbing on 4 streets, at an estimated cost of \$10,000 and \$3,675 respectively.

Welland, Ont.

Tenders will be received by Robert Cooper, Council Clerk, Welland, until noon, March 3rd, for crushed stone, size 1-in., 2-in. and 3-in., rubble stone and dust, per ton, f.o.b. cars, at the several points in the County of Welland. Sample to accompany tender.

CONTRACTS AWARDED

Beaverton, Ont.

The contract for cement sidewalks has been awarded by the Town Council to Curran & Clements, Orillia, Ont.

Medicine Hat, Alta.

A contract has been awarded by the City Council to Kennedy, Scanlon & Hall for pumps at the sewage station, operated by electric motor to be installed by city, \$6,100.

Niagara Falls, Ont.

The City Council has awarded to Louis Sacco the contract for 3,000 ft. 24-in. tile sewer on Maple St.

Toronto, Ont.

The following contracts for sewers have been awarded by the Board of Control: Grant Contracting Co., 50 Front E., Coxwell Ave., Gerrard to Danforth, \$10,325; J. H. McKnight Constr. Co., Gerrard St., Morley Ave. to Redwood, \$2,290; Routly & Summers, Benlamond Ave., Waverley Rd., north limits, Lot No. 48, to Kingston Rd., \$1,879; Commissioner of Works, Fir Ave., from Balsam to Beech, \$910.

The contract for sewer on Gerrard St. E. and Coxwell Ave. has been transferred from Commissioner of Works to Fussell McReynolds Co., Dundas St.

A contract has been awarded by the Board of Control to Wilson, Townsend & Saunders for the construction of a reinforced concrete pumping station for the Central Low Level Area of the Main Drainage Works.

Windsor, Ont.

A contract has been awarded by the City Council to Thomas Chick & Son for the construction of brick sewers on Pierre Ave., Langlois and Josephine Ave.

Winnipeg, Man.

The contract for cast iron water pipe and specials has been awarded by the Board of Control to American Cast Iron Pipe Co., Birmingham, Ala., U.S.A., at \$36,000.

The Board of Control has awarded the following contracts: J. W. Astley, Engineer of Construction, City Yards, for sewers in Armetta Ave., at \$368.25; and sewers in Aikins St., at \$566.95.

Railroads, Bridges and Wharves

Armitage Landin, Ont.

Tenders addressed to R. C. Desrochers, Secretary, Public Works Department, Ottawa, will be received until 4 p.m., March 4th, for the construction of 2 breakwaters; float landing for launches; wharf with landing head 36 x 100; 16-ft. approach, wharf 420 ft. long, 308 ft. of which will consist of timber and the balance, 112 ft., of stone and earth. Freight sheds, 16 x 24, 29,000 ft. board measure, 2-in., 3-in. and 4-in. planking; 153,000 ft. board measure timbers. Plans, etc., at the office of District Engineer, Confederation Life Bldg., Toronto, Postmaster, Dunrobin, and at the Department, Ottawa.

Cobourg, Ont.

Tenders will be received by Public Works Dept., Secretary, R. C. Desrochers, Ottawa, until 4 p.m., March 11th, for the removal of the old pier by dredging, etc., and the reconstruction of a new centre pier, 631 ft. long by 18 ft. wide, timber, stone and iron construction, concrete superstructure. Approximate materials,—Dredging 12,424 cu. yds., timber 45,000 ft. B.M., concrete 1,500 cu. yds., steel corner plates 5,000 lbs.

Carleton County, Ont.

The County Council has instructed the Roads & Bridge Com. to appoint an engineer with regard to the projected bridge.

Dover Twp., Ont.

Tenders for the construction of 11 bridges will be received by Jno. Welsh, Twp. Clerk, Chatham, until noon, Feb. 28th. Engineer in charge, W. G. McGeorge, C.E., Chatham.

East Ferry, N.S.

Tenders will be received by Public Works Dept., Secretary, R. C. Desrochers, Ottawa, until March 11th, for the construction of a wharf. Plans, etc., at the Department, Ottawa.

Hamilton, Ont.

Tenders will be received by the Chairman, Board of Control, until noon, Feb. 23rd, for the construction of bridge and approaches across ravine in West Hamilton. (a) Steel bridge in place; (b) concrete bridge floor, abutments, pedestals, piling, grading, macadamizing, approaches and fencing; (c) bulk tenders for bridge and approaches complete as indicated in (a) and (b). Plans and specifications at the office of the City Engineer, Hamilton.

London Twp., Ont.

The Twp. Council is about to purchase the structural steel required for a number of small bridges to be built by day labor.

Montreal, Que.

Plans are in progress and tenders will be called after May 1st for the construction of a conduit for the Tramway Company's main from power house on William St. along William to McGill Street, to Notre Dame St., and branching there; one to go along Notre Dame St. and up St. Lawrence. The other along McGill St. to Craig St. to and up Bleury St.

Plans are in progress, and tenders will be called after April 1st for the construction of conduits on St. Lawrence St., from the River to Sherbrooke St., Craig St., from McGill St. to St. Lawrence St., Fortification Lane, from

McGill St., to St. Lawrence St.; St. James St., from McGill St. to St. Lawrence St.; and Notre Dame St., from McGill St. to St. Lawrence St.

The construction of conduits on all streets between McGill St. and St. Lawrence St., and Notre Dame St. and the River, is being considered by the city authorities.

Nelson Twp., Ont.

The construction of a high level steel arch bridge, 3 or 4 spans, about 400 ft. long by 20 ft. wide, 75 ft. high, of cement substructure, is being considered by the county authorities.

North West Cove, N.S. (Tancook Is.)

Tenders for the construction of a breakwater will be received by R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa, until 4 p.m. March 2nd, Plans, etc., at office of District Engineers, Halifax, N.S., Antigonish, N.S., Postmaster, North West Cove, and at the Department, Ottawa.

Province of Ontario

The Huron County authorities will proceed this spring on the construction of Kirk's Bridge on the line between Perth and Huron.

Ottawa, Ont.

The sum of \$17,000 for repairs to bridges has been included in the Public Works estimates for 1914.

Owen Sound, Ont.

Plans for a new G. T. R. station have been drawn; the specification calls for two storeys, brick construction, slate and shingle roofing, steam heating, cement and hardwood floors, plumbing, lime and sand plastering, office equipment. Supt., C. F. Forrester, Stratford, Ont.

Richibucto, N.B.

Tenders for extension of breakwater will be received by Secretary Public Works Dept., R. C. Desrochers, Ottawa, until March 16th. Plans, etc., at the Department, Ottawa.

Toronto, Ont.

The estimates include the following items of proposed bridge construction in the city. A new low-level bridge over the Don at Winchester St., \$71,500; Moore Park bridge connecting the eastern and western sections of St. Clair Ave., \$335,000; a bridge over the south ravine at Glen Road, Rosedale, \$80,000; a new bridge to replace the present structure over the railway yards at Dundas St., \$148,000; a new structure over the north ravine at Glen Road, Rosedale, \$310,000; a new bridge to replace the present structure over the railway tracks at Spadina Ave., \$106,000; and bridges at Sherbourne St. and Huntley St., costing \$351,000 and \$80,000 respectively.

Toronto, Ont. (Locust Hill)

Frank Barber, 57 Adelaide E., Toronto, engineer, estimates the cost of the high level bridge over Rouge River at \$20,000 and a committee has been appointed to report on the matter at next meeting of the municipal council.

Toronto, Ont. (Markham)

The Village Council has passed a by-law for the erection of a new bridge at Cedar Grove, 10th Concession. Work is to start in the spring.

Vancouver, B.C.

Tenders will be received by Wm. Mc-

Queen, Clerk to the city council, until 4 p.m., March 4th, for the construction of viaducts spanning the G. N. cut at Hastings, Pender, Keefer and Harris Sts. Separate tenders are required for each viaduct, and also for the four collectively. Plans, etc., at office of Engineer, F. L. Fellowes, City Hall.

Windsor, Ont.

The Detroit & Windsor Ferry Company propose constructing a concrete dock and waiting rooms.

CONTRACTS AWARDED

Little Sands, P.E.I.

The breakwater contract has been awarded by the Public Works Department to Phillips, Mutch & McLean, Charlottetown. The work is to start in the spring.

Ottawa, Ont.

The sum of \$35,000 has been included in estimates for 1914 for addition to Eastern Dept. Block.

Public Buildings, Churches, Schools, etc.

Province of Alberta

The Beverly School District No. 2292 will borrow \$20,000 to extend the existing school building. Chairman, Thos. R. Dando, Beverly.

Burford, Ont.

The sum of \$20,000 for the erection of a post office building was included in the estimates.

Bassano, Alta.

Tenders are to be called shortly for the erection of post office and custom house at a cost of \$35,000.

Battleford, Sask.

The sum of \$5,500 has been included in the estimates for improvements to public building.

North Battleford, Sask.

The sum of \$30,000 has been included in the estimates for the erection of a public building.

Burford, Ont.

The Trinity Church Congregation will probably build a new parish hall this summer.

Canora, Sask.

The sum of \$10,000 has been included in the estimates for public building purposes.

Cayuga, Ont.

Plans have been prepared for addition to the school by the Public School Bd.

Carman, Man.

Tenders will be received by R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa, until 4 p.m., Feb. 26th, for the erection of a public building. Plans, etc., at office of H. E. Matthews, Lindsay Bldg., Winnipeg, Man., and at the Department, Ottawa.

Compton, Que.

The Municipality of Compton has under consideration the erection of a town hall.

Dundas, Ont.

The erection of a high school at a cost of \$30,000 is being considered by the Board of Education and the following committee has been appointed: Jos. Irwin, W. J. Kerr, Dr. Lyman C. Laughland.

Edmonton, Alta.

The Edmonton Exhibition Association has plans in progress for the erection of two cattle barns, an addition to the manufacturers building and to complete the heating of the stock pavilion; the sum of \$75,000 is needed and a by-law will be voted on shortly.

A by-law will be submitted to the ratepayers about March 10th to raise \$250,000 in addition to \$100,000 already voted, for the erection of an isolation hospital.

Elmira, Ont.

Tenders will be called shortly for the erection of a Church on Arthur Street for the St. James Lutheran Church congregation at a cost of \$20,000. Architects, Colwill, Tanner & Co., Traders Bank Bldg., Guelph.

Fredericton, N.B.

The Board of School Trustees have plans in progress for a 2-storey school building on Smythe Street at a cost of \$37,500. Architect, G. Ernest Fairweather, 84 Germain St., St. John, N.B.

Hamilton, Ont.

The Roman Catholic Episcopal Corporation has purchased a site near the Delta in east section of city for the erection of a church.

Hazeldean, Ont.

Plans are in progress for the erection of a Masonic hall. Architect, W. Herbert George, Castle Bldg., Queen St., Ottawa.

Hamilton, Ont.

The General Hospital Board is having plans prepared for additions to the hospital; estimated cost \$100,000. Architects, Stewart & Witton, 7 Hughson Street.

Kentville, N.S.

The Presbyterian Church Congregation has appointed the following building committee: Rev. R. B. Layton, W. W. Rockwell, A. A. Thompson and Thos. Weaver, who will discuss the question of proposed new church.

Kenora, Ont.

Tenders may be called shortly by the Dept. of Marine & Fisheries for the construction of a fish hatchery.

The Town has agreed to grant a site to the Library Board for the erection of a public library at an estimated cost of \$15,000.

Kinersley, Sask.

The sum of \$20,000 has been included in the estimates for public building purposes.

Kingston, Ont.

The addition of a small wing to the Aged People's Home, Montreal Street, for a laundry and drying department, is contemplated.

Lethbridge, Alta.

The sum of \$120,000 has been included in the estimates for public building purposes.

London, Ont.

The Y. M. C. A. authorities are considering the erection of a new building on Dundas street.

The Board of Education has appointed Mr. A. E. Nutter, Dundas and Richmond streets, architect, in connection

with the proposed school buildings on Grand Ave., Riverview Ave., and Princess Avenue.

Medicine Hat, Alta.

The sum of \$35,000 has been included in the estimates for addition to the public building.

Montreal, Que.

C. E. Deakin, 41 Mayor St., who has the contract for the Boxes building, Hospital St., is taking tenders now for some trades.

H. Dunlop & Morrison, architects, 454 Old Birks Bldg., will receive tenders for general contract about April 1st, for the erection of a \$200,000 office building on Phillips Place. The specification includes: ten storeys, 29 x 124, concrete foundation, waterproofed, marble, terra cotta, fireproof, steel, hollow tile and tapestry brick construction.

Extensions to the Trafalgar Institute School are contemplated. Chairman, Rev. Jas. Barclay, D.D., 27 Sherbrooke St. W. Architects, Hogle & Davis, 80 St. Francois Xavier Street.

The Taylor Presbyterian Church, Masson & Papineau Streets, will be re-decorated in the spring. Tenders will be called later.

Montreal, Que. (Notre Dame de Grace).

Tenders for general contract received by Peden & McLaren, architects, 20 St. Alexis St., Montreal, from Feb. 23rd to March 2nd, for the erection of new Loyola college building. Estimated cost \$400,000.

Moose Jaw, Sask.

The following items have been included in the estimates: Immigration hall, \$50,000; customs examining warehouse, \$100,000.

Nelson Twp., Ont.

Mills & Hutton, architects, Bank of Hamilton Bldg., have plans in hand for solid pressed brick construction school building for No. 15 school section, \$10,000.

Oakville, Ont.

The Town Council, W. E. Crawley, Clerk, will receive tenders for the erection of a fire hall and hose tower on Mary street.

Ottawa, Ont.

The French Baptist Church congregation propose to erect a new church and the following committee has been appointed: L. Blais, King Edward, C. St. Germain, M. Groulx, E. White. Secretaries, E. Viens, 149 Arlington.

The plans for the new Perley Memorial Home on Aylmer Ave., have been accepted. Architects, Horwood & Taylor, 130 Sparks Street.

Librarian Sykes will make a report to the library committee regarding the projected branch library on Ottawa St. E.

R. Percy Sims, architect, 146 Lemoine St., Montreal, has been asked by the city council to draw up tentative plans for a 2-storey concrete abattoir. The estimated cost is \$100,000.

The Public School Board has plans in progress, involving an expenditure of \$5,000, on the erection of a manual training school on Kent Street.

The Public Works Department has

(Continued on page 77)

Tenders and For Sale Department

Tenders

Tenders will be received by the undersigned until 5 p.m., **February 23rd, 1914**, for all trades in connection with the erection of a new Public School Building to be erected in the Town of Thorold, Ont. Plans and specifications may be seen at the office of the Contract Record, Toronto, Ont., the Public Library Building, Thorold, Ont., and A. E. Nicholson, Architect, 46 Queen Street, St. Catharines, Ont.

The lowest or any tender not necessarily accepted.

A. E. NICHOLSON, O.A.A., Architect,
46 Queen Street, St. Catharines, Ont.

Stone Macadam Road

Sealed tenders will be received up to noon on the **2nd day of March, 1914**, by the undersigned at Cayuga, Ont., for the construction of twenty-six and one-half miles of stone macadam road in the County of Haldimand. The work will be let in three separate and distinct contracts, not necessarily to the same individual. Tenderers should tender for each contract separately. The work to be done on Contracts Nos. 1 and 2 is situated on the Hamilton and Port Dover Plank Road, and that on Contract No. 3 is situated on the Talbot Road. Each section has convenient shipping points.

Tenderers are requested to examine the localities of the work and plans and specifications for the same may be seen at the office of the County Engineers, Messrs. Jackson & Kyd, Dunnville, or may be had from them on the payment of \$10.

Lowest or any tender not necessarily accepted.

T. A. SNIDER, K.C., County Clerk,
County of Haldimand, Cayuga, Ont.



Sealed tenders addressed to the undersigned, and endorsed "Tender for Centre Pier at Cobourg, Ont.", will be received at the office until 4 p.m., on **Wednesday, March 11, 1914**, for the construction of the Centre Pier at Cobourg, Northumberland County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Bldg., Toronto, Ont.; Windsor, Ont., and on application to the Postmaster at Cobourg, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering declines to enter into a contract when called upon to do so, or fails to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,

Secretary.

Department of Public Works,
Ottawa, February 10, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—55514.

7-8

Tenders

Tenders will be received by the undersigned until 5 p.m., **March 6th, 1914**, for all trades required in connection with the erection and completion of a new Public School Building to be erected in the Town of Welland. Plans and specifications may be seen at the office of the Contract Record, Toronto, Mr. J. McCaw, Secretary, Public School Board, Welland, Ont., and A. E. Nicholson, Architect, 46 Queen Street, St. Catharines, Ont.

The lowest or any tender not necessarily accepted.

A. E. NICHOLSON, O.A.A., Architect,
46 Queen St., St. Catharines, Ont.

TOWNSHIP OF BRANTFORD

White Bridge Contract

Sealed tenders, clearly endorsed on the outside "Tender for Superstructure," will be received by the Township of Brantford up to noon on **Saturday, 28th February, 1914**, for the manufacture and erection of a "Class C" steel highway bridge with 18-foot roadway and a clear waterway of 80 feet over Fairchild's Creek on the Hamilton Rd.

Specifications and instructions to bidders may be had from Jackson & Company, Temple Building, Brantford.

Tenders should be addressed to the Township Clerk, County Buildings, Brantford.

ALAN MAIR JACKSON,
Township Engineer.

6-7

CITY OF MONTREAL

Direction of Public Works Water Department

Sealed tenders endorsed "Tender for Filtration Plant, Construction of Buildings," addressed to the Board of Commissioners, will be received up to noon of **Tuesday, March 3rd, 1914**, for the construction of the following works, forming a portion of the Filtration Plant of the City of Montreal.

1. Pumping Station, Wash Water Tower, Superstructures of Filter Building and Gate Houses Nos. 1, 2, 3, 4, 5, 6, and 7 and appurtenances.

1a. Alternative price if superstructure of buildings are built of brick instead of concrete.

2. Additional earth work, 1,000 cubic yards.

3. Additional concrete, 100 cubic yards.

Plans and specifications may be seen at the office of the Chief Engineer of Public Works of Montreal at the City Hall, and at the offices of Hering & Fuller, 170 Broadway, New York City, and of the Contract Record and Engineering Review, Toronto. Copies may be obtained upon depositing \$25 to cover cost of same, which sum will be refunded to bona fide tenderers and others returning plans, etc., in good condition before the closing date for receiving tenders.

No tender will be considered unless made on the blank form supplied, and unless accompanied in the same envelope by a certified cheque for \$15,000 on a chartered bank of the Dominion of Canada, payable to the City Treasurer at the City of Montreal.

Tenders will be opened in the presence of the interested parties by the Board of Commissioners at noon of **March 3rd, 1914**.

The Board of Commissioners reserve the right to reject the lowest or any tender.

By order of the Board of Commissioners,

L. N. SENECA, Secretary.

Commissioners Office,

City Hall, Montreal, Que.

February 2nd, 1914.

6-7

The Village of Point Edward Province of Ontario

Tenders for Water Works

Sealed tenders registered and clearly marked on the outside of the envelope:—Tender "A" or "B" as the case may be and addressed to the Village Clerk, Point Edward, Ontario, will be received up to 8 p.m. **Saturday, February 28th, 1914**, for the supply of material and the construction of:—

Contract "A"—Labor of laying approximately 4,000 feet of 6-inch pipe
10,000 feet of 4-inch pipe
with valves, hydrants, etc.

Contract "B"—Furnishing Cast Iron or Steel Water Pipes and Specials.

Contract "C"—Furnishing Valves, Hydrants, Cocks, Lead Pipe, etc.

Copies of plans, specifications, instructions to bidders, etc., may be seen at the office of H. A. McLean, Engineer, Room 5, Town Hall, Sarnia, or at the office of the Contract Record, Toronto, on and after **February 7th, 1914**.

Persons tendering are notified that tenders will not be considered unless made on forms supplied. Forms will be mailed upon request to the Engineer or Clerk.

Dr. A. S. McLaren, Reeve,
D. J. McDougall, Chairman of
Fire and Water Committee.

Point Edward.

7-8

To Bridge Contractors

Second Narrows Bridge

Vancouver, B. C.

The Burrard Inlet Tunnel & Bridge Company, 513-514 Carter Cotton Building, Hastings Street, Vancouver, B.C., are prepared to receive tenders for the construction of a Bridge across the Second Narrows of the Burrard Inlet to connect the City of Vancouver and the Municipality of North Vancouver by means of a single line of steam track, two lines of electric car track, two lines of roadway and a footway, together with the necessary approaches thereto, as well as the machinery for working the opening span of the Bridge and other incidental works.

The contract drawings, specifications and schedule of quantities may be seen on and after 21st of January at the offices of the Consulting Engineers, Sir John Wolfe Barry, Lyster & Partners, 2 Queen Anne's Gate, Westminster, England, on and after 19th January at the offices of the company's agents, Messrs. Pringle & Guthrie, Citizen Building, Sparks Street, Ottawa, Ont., and on and after 26th January at the offices of Messrs. Cleveland & Cameron, Civil Engineers, 1001-1010 Rogers Building, Granville and Pender Streets, Vancouver, B.C., between the hours of eleven and four (Saturdays excepted) in each case.

Copies of the drawings, specifications, schedule of quantities and form of tender may be obtained at each of the above offices upon payment of \$100 in Canada and £21 in England, which fee will be returned on receipt of a bona fide tender accompanied by the specification and drawings which are to be returned with the tender.

Tenders endorsed "Tender for Second Narrows Bridge," must be delivered under seal addressed to the Secretary of the Burrard Inlet Tunnel & Bridge Company on or before noon on **Wednesday, the 1st day of April, 1914**.

The lowest or any tender will not necessarily be accepted.

EUSTACE J. COCKRELL,
Secretary of the Company.

5-7

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent., an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929, Contract Record, Toronto. 53-12

CITY OF MONTREAL

Automobile Fire Trucks and other Apparatus

Sealed tenders addressed to the Board of Commissioners and deposited in their Office in the City Hall, will be received until twelve o'clock noon, on **Thursday, the 26th day of March, 1914**, for the supply and delivery of the undermentioned apparatus, viz:—

- (a) One Automobile Salvage Waggon.
- (b) Four Automobile Tractors.
- (c) Two Automobile Hose Waggon.
- (d) One 85 ft. Aerial Ladder, Automobile Truck.
- (e) One Automobile Fire Engine, of a capacity of 1200 American Gallons.

Specifications, forms of tender and envelopes, together with all information required, may be obtained at the Office of the Purchasing and Sales Agent, City Hall, and no tender will be considered unless made on said forms and enclosed in said envelopes.

The Board of Commissioners reserve the right to reject all or any of the tenders.

The tenders will be opened by the Board of Commissioners in the presence of the interested parties, at their regular meeting in their Board Room at the City Hall, at twelve o'clock noon, on **Thursday, the 26th day of March, 1914**.

By order of the Board of Commissioners,

L. N. SENEAL, Secretary.

Board of Commissioners' Office,
City Hall,
Montreal, February 10th, 1914.

7-8



Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Palmerston, Ontario," will be received at this office until 4 p.m. on **Monday, March 9, 1914**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, Ont., The Postmaster, Palmerston, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,

Secretary.

Department of Public Works,
Ottawa, February 13, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—47749

7-8

AGENTS WANTED FOR CONCRETE MIXERS

A large Canadian firm about to manufacture concrete mixers on an extensive scale wants sales agents in Ontario, Quebec, Maritime Provinces, Winnipeg, Calgary, Vancouver. Apply Box 962, Contract Record, Toronto. 6-8

Notice to Contractors

Water Works Supplies

Sealed tenders addressed to the Chairman of the Waterworks Committee, City Hall, Ottawa, will be received by the Secretary of the Waterworks Committee, up to 4 p.m., **Tuesday, February 24th, 1914**, for the supply and delivery of Brasswork, Special Pipe Castings, Hydrants, Cast Iron Pipe, Lead Pipe and Pig Lead, Valves, Oils and Grease as the case may be.

Specifications, form of tender and full particulars may be obtained on application at the City Engineer's Office, City Hall, Ottawa.

Any tender received after the above stated time will be declared informal.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,

City Engineer.

Ottawa, February 6th, 1914.

6-7

Notice to Contractors

Civic Supplies

Sealed tenders addressed to the Chairman and Members of the Board of Control, City Hall, Ottawa, will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., **Tuesday, February 24th, 1914**, endorsed "Tender for Broken Stone, Brick, Stone Setts, Cement, Plank and Cedar, Sand, Asphalt, Castings, Street Sweepers' Brooms, Street Sweepers' Buckets and Carts, or Draughting Supplies," as the case may be.

Specifications, form of tender and full particulars may be obtained on application at the City Engineer's Office, City Hall.

Any tender received after the above stated time will be declared informal.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,

City Engineer.

Ottawa, February 6th, 1914.

6-7



Mail Contract

Sealed tenders, addressed to the Postmaster General, will be received at Ottawa until noon, on **Friday, the 20th of March, 1914**, for the conveyance of His Majesty's mails, on a proposed Contract for four years, six times per week each way, over Locust Hill (via Green River, Bringham, Whitevale and Greenwood) Rural Mail Route, from the Postmaster General's pleasure.

Printed notices containing further information as to conditions of proposed Contract may be seen and blank forms of Tender may be obtained at the Post Offices of Locust Hill, Green River, Bringham, Whitevale, Greenwood, and at the office of the Post Office Inspector, Toronto.

A. SUTHERLAND,

Post Office Inspector.

Post Office Inspector's Office,
Toronto, February 3rd, 1914.

6-7-8

For Sale

One standard gauge locomotive in operating condition. Cylinders 24 in. x 18 in.
The Jenckes Machine Company, Ltd.,
6-19 Sherbrooke, Que.

Tenders for Bridge Construction

Sealed tenders addressed to John Allan, Esq., Chairman, Board of Control, Hamilton, Ont., and plainly marked on the outside as to contents, will be received by the undersigned up to 12 o'clock noon on **Monday, February 23rd, 1914**, for the construction of a steel bridge and approaches across ravine in West Hamilton.

Tenders will be received for—

- (a) Steel Bridge in place.
- (b) Concrete bridge floor, abutments, pedestals, piling, grading, macadamising, approaches and fencing.
- (c) Bulk tender for bridge and approaches complete as indicated in (a) and (b).

Each tender must be accompanied by a marked cheque for five per cent. of the amount of the tender, which cheque will be forfeited should the party whose tender may be accepted fail, with his sureties, to execute the contract.

Plans and specifications may be seen at office of the City Engineer, Hamilton.

The lowest or any tender not necessarily accepted.

S. H. KENT,
City Clerk.

Hamilton, February 11th, 1914.

7

Tenders Wanted

Sealed tenders will be received by the undersigned for lump sum or separate tenders for all trades required in the alterations and additions to the Registry Office for the County of Welland in the Town of Welland, up to 12 o'clock noon, **Tuesday, March 3rd, 1914**.

Plans and specifications may be seen at the office of the County Clerk, Welland, Ont.; office of A. E. Nicholson, architect, of St. Catharines, Ont., and the office of the Contract Record, Toronto, Ont.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of H. J. Knoll, Warden, or two personal sureties approved of by the Warden, equal to 10 per cent. of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The County does not bind itself to accept the lowest or any tender.

Tenders to be marked on envelope "Tender for Registry Office."

ROBERT COOPER, County Clerk,
Welland, Ont.

6-8



TENDERS

Sealed tenders, addressed to the Secretary of the Department of the Interior, Ottawa, Ont., and marked "Tenders for Bathhouse, Banff," will be received up to noon, **March 16th, 1914**, for the construction of a bath-house at Banff, Alta.

Plans and specifications may be seen at the offices of the following:—

The Commissioner of Dominion Parks, Ottawa.
The Superintendent of Rocky Mountains Park, Banff, Alta.

The Chief Superintendent of Dominion Parks, Edmonton, Alta.

Agent of Dominion Lands, Calgary, Alta.
Agent of Dominion Lands, Winnipeg, Man.

Agent of Dominion Lands, Regina, Sask.
Immigration Agent, Vancouver, B.C.

The lowest or any tender not necessarily accepted.

The unauthorized insertion of this advertisement in any newspaper will not be paid for.

LYNDWODE PEREIRA,

Secretary.

Department of the Interior,
—5534— Ottawa, Feb. 4th, 1914.

7-8

CITY OF SASKATOON

Tender for Cast Iron Pipe and Specials

Sealed tenders, addressed to the City Commissioners, Saskatoon, and endorsed "Tender for Cast Iron Pipe and Specials," will be received up till noon on Tuesday, March 10th, 1914, for the supplying of the following material:—
12 tons Class "A" Cast Iron Pipe, 12-in.
65 tons Class "B" Cast Iron Pipe, 12 to 24 in.
13 tons Class "B" Specials, 12 to 24 in.
9 Gate Valves 12 to 20 in.

The Corporation reserves the right to divide the material into three contracts, and to reject any or all tenders.

All information may be obtained on application to Mr. Junius Jonsson, Acting City Engineer.

F. E. HARRISON, Mayor,
Chairman of City Commissioners.
Saskatoon, February 7th, 1914. 7-8



Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on Tuesday, March 3rd, 1914, for the construction of the following sewers, viz:—

Clendennan Ave., from Annette St. to Dundas St.
Danforth Ave., from Woodbine Ave. to Main St.
Evelyn Ave., Annette St. to St. John's Road.
Fairview Ave., from Annette St. to St. John's Rd.
Gillard Ave., from Felstead Ave., Danforth Ave.
Grace Terrace, from Heath St. to Moore Ave.
Hannaford St., from Kingston Rd. to Gerrard St.
Heath St., from Grace Terrace to McClinton St.
Hillsview Ave., from Keele St. to West Limit Lot No. 21, Plan 587.

Jennings St., from Clendennan Ave. to W. End.
Keele St., from Conduit St. to Annette St.
Kennedy Ave., from Bloor St. to Glenwood Ave.
Kimberley Ave., from Lyall Ave. to Gerrard St.
Kent Rd., from Queen St. to North End.
Kingswood Ave., from Queen St. to Gerrard St.
Lane first west of Crawford St., Harbord St. to lane second south of Bloor St.

Lawes Ave., from Annette St. to St. John's Rd.
Lawlor Ave., from Kingston Rd. to Gerrard St.
Lyall Ave., from Main St. to Wayland Ave.
Melgund Rd., from Wells Hill Ave. to 120 ft. N.
Moore Ave., from Fern St. to Grace Terrace.
Osborn Ave., from Lyall Ave. to Gerrard St.
Pleasant Ave., from Grace Terrace to east end.
Quebec Ave., from Annette St. to Dundas St.
Rosehill Ave., from Grace Terrace to west limit, Lot No. 1, Plan 920-K.

Rosepark Ave., from Grace Terrace to Welland Ave.

Rowland St., from Clendennan Ave., to W. End.
Runnymede Rd., from Annette St. to Clair Ave.
St. Clair Ave., from Grace Terrace to Welland Ave.

Wamsley Blvd., from Baker Ave., to Lawton Ave.
Wayland Ave., from Lyall Ave. to Gerrard St.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved by the City Treasurer, not members of the City Council or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, February 12th, 1914. 7

To Contractors

Sealed bids will be received for all trades required in the erection of alterations and additions to a residence in Rosedale, up to noon of Friday, February 27th, 1914.

The lowest or any tender not necessarily accepted.

F. S. BAKER, Architect.
Royal Bank Bldg., Toronto. 7

Tenders for Cement Walks

Tenders will be received by the undersigned, until 6 p.m. Saturday, February 28th, 1914, for the construction of certain Granolithic Walks in the Town of Sudbury.

Approximating 8240.9 lineal feet.

Locations, specifications and forms of tender may be obtained by application to Town Clerk, Sudbury.

Tenders to be sealed and marked "Tenders for Cement Walks."

The lowest or any tender not necessarily accepted.

Marked cheque for five per cent. of value of work to accompany tender.

Granolithic walks other than above are in contemplation for the season of 1914.

Dated at Sudbury this 29th day of January, 1914.
5-8 W. J. ROSS, Town Clerk.

\$1,000.00 IN PRIZES

One Thousand Dollars to Win

Competition

Open to all Civil Engineers or Architects for the building of a Grand Stand at the Quebec Provincial Exhibition Grounds

The Commission of the Quebec Provincial Exhibition, by a resolution passed on February 6th, 1914, has decided to invite a competition, open to architects or civil engineers only, of designs, plans, elevations, vertical section, scale design to be one-eighth inch to the foot, with estimate, for the building of a modern grand stand, on the site of the actual stand, permanent structure, built of steel and concrete, with seating capacity of at least 8,000 (eight thousand) people; the design or the plan, in the interior of the building, must provide necessary accommodations for a large restaurant, administration headquarters, rooms for exhibits, etc.

The cost of the building must not exceed \$100,000 (one hundred thousand dollars), and every competitor must supply the conviction that, under ordinary circumstances, his plan, as far as the stand proper is concerned, can be carried out for the forthcoming Quebec Exhibition to be opened on August 29th, 1914.

The time for competition will last until March 10th, 1914, at 4 p.m. The invoices of the competition must be sealed and forwarded to the undersigned, and will become the property of the Commission, which engages itself to grant three rewards, according to the decision of the jury: First Prize, \$500.00 (five hundred); Second Prize, \$300.00 (three hundred); Third Prize, \$200.00 (two hundred).

For further information, which will not be given after March 1st next, apply to

GEORGES MORISSET,
Secretary.
The Commission of the Quebec Provincial Exhibition, City Hall, Quebec.
Quebec, February 9th, 1914. 7

For Sale

Thirty Standard Gauge Flat Cars in good condition; will pass M.C.B. inspection; 30 ton capacity, equipped with air brakes.

JOHN J. GARTSHORE,
7-8 Toronto, Ont.

CANADIAN PACIFIC RAILWAY COMPANY

DEPARTMENT OF NATURAL RESOURCES

ENGINEERING BRANCH

TENDERS FOR CONCRETE CONSTRUCTION

Sealed tenders, addressed to the undersigned and endorsed "Tenders for Concrete Structures," will be received up to noon of March 14th, 1914. The work to be let includes the concrete (Irrigation) structure in about half of the area comprising the Eastern Section of the Company's Irrigation Block, Alberta. Materials, except for forms, will be furnished by the Company. Materials for forms and all labor must be furnished by the Contractor. The approximate quantities are:—3,800 cubic yards of concrete and 192,000 pounds of reinforcing steel. The quantities in individual structure vary from 15 cubic yards to 80 cubic yards.

Plans, specifications, and full information will be furnished on application to the undersigned. A deposit of \$50.00 will be required before plans, etc., will be given out, which will be refunded on their return in good condition.

All proposals must be accompanied by a certified cheque, payable to the undersigned, for five per cent. of the amount of the tender, to be forfeited as liquidated damages should the bidder neglect or refuse to enter into a contract in the event that the work is awarded to him.

Proposals must be made on the standard form provided. Alterations thereto, interlineations or qualification of prices may invalidate the bid.

The right is reserved to reject any or all bids and to waive defects.

A. S. DAWSON,
Chief Engineer.
Calgary, Alberta. 7-9

Tenders Wanted

BOARD OF EDUCATION

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, February 27th, 1914

For the completion of

Duke of Connaught School

Carpenter work
Plastering
Painting
Plumbing
(Also Plumbing at other schools)

Harbord St. Collegiate Institute

Mason work
Structural Steel work
Ash Hoist

Furniture

Teachers' desks, tables and chairs

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted.

All tenders must be on revised forms.

J. W. JACKSON,
Chairman of Committee.
W. C. WILKINSON,
Secretary-Treasurer.

City Engineer Wanted

The Corporation of the City of Swift Current are prepared to receive applications for the position of City Engineer. Applications accompanied with copies of testimonials only, stating experience and salary desired, to be lodged with the undersigned on or before March the 2nd, 1914.

GEO. D. ARNOTT, City Clerk,
Swift Current, Sask.



Tenders for the Supply and Erection of Steelwork for the New Gerrard Street Bridge Over the Don

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on Tuesday, April 14th, 1914, as follows:

- (1) For steelwork fabricated and erected complete.
- (2) For the steelwork fabricated and delivered f.o.b. cars at the bridge site.
- (3) For the unloading of the steelwork at the site and the erection of same.

Specification and tender form may be obtained upon application to the office of the Railway and Bridge Section, Department of Works, City Hall, Toronto. Envelopes containing tenders must be plainly marked on outside as to contents. Conditions relating to tendering as prescribed by City By-law must be strictly complied with or the tenders may be declared informal. Tenderers shall submit with their tenders the names of two bona fide personal sureties approved by the City Treasurer, or in lieu thereof, the bond of a guarantee company approved as aforesaid. The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

City Hall, Toronto,
February 16th, 1914.



Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Wellington, Ont.," will be received at this office until 4 p.m., on Monday, March 16, 1914, for the construction of Harbour Improvements at Wellington, Prince Edward County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of the District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Wellington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering declines to enter into a contract when called upon to do so, or fails to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, February 16, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department—55933.

Tenders Received

Tenders will be received by the undersigned up to 5 p.m., Monday, March 2nd, for approximately 25 Fire Hydrants. Full particulars may be had at the office of the City Engineer.

The lowest or any tender not necessarily accepted.

M. FERGUSON,
St. Thomas, February 16 1914. City Engineer.
7-8

Tenders Received

Tenders addressed to the undersigned, will be received by the Corporation of the Village of Philipsburg, Que., up to 6 p.m. on Friday, the 27th day of February, 1914, for the construction of a protection wall, and the raising and graveling of the road on the Lake Shore.

Further particulars and specifications can be had from the Secretary-Treasurer.

Security to the amount of 20 per cent. of the price of the contract awarded must be given by the Contractor, for the due performance of such work, and for the payment of all damages, costs and interest, in the event of his not fulfilling the contract.

The Council does not bind itself to accept the lowest or any tender.

By order,

A. H. BORDEN,
Philipsburg, Que., Secretary-Treasurer.
February 16th, 1914. 7

Wanted Employees

WANTED — SALES AGENTS

A large Michigan firm manufacturing concrete mixers wants to secure reliable sales agents for Ontario, Quebec and Eastern Canada. A liberal proposition will be made to any firm having a good organization to cover the whole or part of this territory. Apply Box 959, Contract Record & Engineering Review, Toronto. 6-8

Representatives Wanted

The Industrial News Association, Cromwell Buildings, Manchester, Eng., invites communications from those open to represent U. K. manufacturers of engineering, contracting plant, and building materials and equipment. Full particulars are required as to territory covered and facilities for handling sound propositions. Credit and other references are required. 5-6-7

Public Buildings, Churches, Schools, &c.

(Continued from page 73)

under consideration the erection of a drill hall.

The following items were included in the Public Works Department estimates for 1914: Departmental buildings, including cost and site, \$1,000,000; customs building, \$500,000; general repairs, furniture and lighting of departmental buildings, \$415,000; additions to Parliament buildings, \$100,000; additions to astronomical observatory, \$80,000; department buildings fittings, \$75,000; Victoria Memorial Museum, \$40,000; addition of one storey to the Royal Mint refinery, \$35,000; improvements to departmental buildings, \$17,000; improvements to the departmental buildings grounds, \$35,000.

The Public School Board is considering the expenditure of \$5,500 on repairs and alterations to Kent St. school, and the sum of \$6,000 on alterations and repairs to Percy St. school.

Plans have been drawn and approved by the Public School Board for addi-

tions to Hopewell St. school; estimated cost \$85,000. Architect, W. B. Garvock, Creighton St. School.

Peterboro, Ont.

A by-law will be submitted shortly to the ratepayers, providing for the expenditure of \$10,000 on the erection of a sanitarium for the Peterboro Health Association.

Prince Albert, Sask.

The sum of \$40,000 has been included in the estimates for the erection of a drill hall.

Regina, Sask.

The erection of a guard room at a cost of \$20,000 for the Royal North West Mounted Police is being considered.

The following items are included in the estimates for 1914: Customs warehouse, \$75,000; and armory \$75,000.

Revelstoke, B.C.

The C. P. R. will probably build a chalet on the mountain.

The Govt. Architect, Victoria, is preparing plans for the erection of a post office here.

Saskatoon, Sask.

The estimates for 1914 include the following items: Customs examining warehouse, \$50,000; and for public building purposes, \$100,000.

St. George, N.B.

Tenders for a public building will be received by R. C. Desrochers, Secretary, Dept. of Public Works, Ottawa, until 4 p.m., March 2nd, Plans, etc., at office of Mr. Waterbury, Supt. of Bldg., St. John, N.B., and at the Department, Ottawa.

Swift Current, Sask.

The estimates for 1914 include the following items: Drill hall, \$30,000; and for public building purposes, \$50,000.

Smiths Falls, Ont.

The Minister of Militia, Col. S. Hughes, has assured the Town that a new armory building will be erected. The cost is expected to be in the neighborhood of \$60,000.

The Separate School Board contemplate building a new four-room building in the spring.

Stratford, Ont.

Plans are being prepared for a new school in Avon Ward. Accommodation for a manual training and domestic science will be provided.

Thorold, Ont.

Tenders will be received by A. E. Nicholson, architect, 46 Queen St., St. Catharines, until 5 p.m., Feb. 23rd, for the erection of a school building. Plans and specifications at Public Library Building, Thorold, offices of Architect, St. Catharines, and Contract Record, 220 King St. W., Toronto.

Toronto, Ont.

A site has been purchased at 46 Murray St. by the Hebrew Hospital Association for the erection of a hospital. Rabbi Levy, 18 Alice St., and M. Gold, 224½ Simcoe St., are interested.

Wadena, Sask.

The sum of \$20,000 has been included in the estimates for public building purposes.

Welland, Ont.

Tenders will be received by A. E. Nicholson, Architect, 46 Queen Street,

St. Catharines, until 5 p.m., March 6th, for a public school building, estimated cost \$30,000. Plans and specifications at offices of Secretary, Architect, St. Catharines, and Contract Record, 220 King St. W., Toronto.

Collective or separate tenders for alterations and addition to registry office will be received by Robert Cooper, County Clerk, until noon, March 3rd. Plans and specifications at offices of Clerk; A. E. Nicholson, architect, St. Catharines, and "Contract Record," 220 King St. W., Toronto.

Wilkie, Sask.

The sum of \$15,000 has been included in the estimates for public building purposes.

Winnipeg, Man.

The estimates for 1914 include the sum of \$75,000 for a postal station in the west end of the city.

A delegation has approached the Bd. of Control to request the paving of the road to the proposed site for the Children's Home on the Assinaboine River.

Woodstock, Ont.

The City Council has appointed a committee to have plans and specifications prepared for a new City Hall, the building is to include cells and police quarters.

Woodstock, N.B.

The Agricultural Society contemplate the expenditure of \$20,000 on the erection of exhibition buildings.

CONTRACTS AWARDED

Hanover, Ont.

The contract for the erection of the post office and customs house has been awarded by the Public Works Department to Henderson, Bath & Patchell, Midland, Ont.

New Waterford, C.B.

The Town Council has awarded to D. J. McIsaac, Glace Bay, N.S., the contract for the erection of the public school building.

Milltown, N.B.

The post office contract has been awarded by the Public Works Department to Jos. McVey & Son, St. Stephen, N.B.

Montreal, Que.

The following sub-contracts have been awarded on the Foundling Hospital:—General contract, Anglins Ltd., 65 Victoria; carpentry, D. M. Long, 39 Windsor; architectural iron, F. A. McKay, 18 St. George; electrical fittings, P. Lahee, 20 St. Nicholas.

Welland, Ont.

The following contracts have been awarded in connection with the high school building on West Main St. Mason, Marcus Vanderburg; carpentry, roofing, painting, electrical and interior fittings, John Thew; steel, Standard Steel Construction Co.; heating and plumbing, E. Cardwell.

Business Buildings and Industrial Plants

Athabasca, Alta.

Revillon Freres are considering the erection of a concrete and brick construction warehouse at a cost of \$40,000.

Brampton, Ont.

Robt. Haffert will probably erect several stores on Main street in the spring.

Mt. Brydges, Ont.

The Union Bank of Canada (T. C. West, Mt. Brydges), propose erecting a bank and office building at a cost of \$7,000.

Calgary, Alta.

A site has been purchased, plans are in progress, and excavating will start at once, for the 6-stys. industrial housing building which the city council are erecting at a cost of \$250,000. Architect, Alex. Pirie, 231 8th Ave. W.

Edmonton, Alta.

Robt. Moore, St. Elmo Hotel, contemplates building a new hotel on the site of the old building. The new building will be ten storeys, 66 x 100, of red pressed brick construction, and the estimated cost is \$300,000.

Plans for a 1-storey factory, 75 ft. by 125 ft., are being drawn for the Edmonton Metal Works, Ltd., 2nd St. and Columbia Ave.

Hamilton, Ont.

F. D. Curtis, Grand Rapids, Mich., temporary office, 168 King St. E., Hamilton, is interested in an effort which is being made to organize a \$250,000 company with a view to erecting large plant for the manufacture of Curtis fire alarms.

London, Ont.

A theatre, stores and garage block on York St., is contemplated by M. Wetzstein, care Ideal Concrete Machinery Company.

Markdale, Ont.

Geo. Watson, Flesherton, Ont., has purchased a site for the erection of a sash and door factory.

Montreal, Que.

The St. James Club, Dorchester and University Sts., is to be entirely remodelled. H. C. Stone, 84 St. Francois Xavier St., will probably be the architect.

H. C. Stone, 84 St. Francois Xavier St., architect, expects to call tenders for general contract in about two weeks, for an office building on Shearer street for Belding Paul Corticelli Ltd.

Ottawa, Ont.

W. E. Noffke, Central Chambers, architect, expects to call for tenders shortly, for the addition of three storeys, 66 x 100, steel and solid brick construction, to the premises of Chas. Ogilvy Ltd., Rideau & Nicholas streets.

Edward Dey, Laurier Ave., and Frank Ahearn, 450 Daly Ave., are interested in the proposed building of an arena with a seating capacity of 12,000, to be used for hockey and skating during the winter and the manufacture of artificial ice during the summer in connection with the Ottawa Artificial Ice Co., Nicholas Street.

J. C. MacDonald, 218 Albert Street, has decided not to erect a new building but to alter the present premises at a cost of \$10,000. Architects, Weeks & Burgess, Citizen Bldg., Sparks Street.

Redcliffe, Alta.

It is not likely that factory of the H. Munderloh Glass Co., of Montreal, will be erected.

Redcliff, Alta.

The Overland Co., Ltd., is considering the erection of a confectionery store and hot house.

Regina, Sask.

The Royal Bank of Canada will probably build a branch office on 11th Ave. Local manager, R. L. Ritchie.

Sherbrooke, Que.

Plans for store and tenements on King St., to cost \$5,000, have been drawn for A. Auger, Sherbrooke.

Stratford, Ont.

The ratepayers will vote on by-law Feb. 27th, granting fixed assessment and \$2,500 towards purchase of site to Morlock Bros., Ltd., Maple Ave., Hanover, for the erection of an upholstering factory.

A by-law will be submitted to the ratepayers Feb. 27th granting fixed assessment and allowing part of College street to be closed in connection with the proposed extensions to the factory of the Stratford Mfg. Co., Ltd.

A by-law will be voted on by the ratepayers Feb. 27th, granting \$3,500 to Chas. Diebel, Victoria St., Hanover, towards the purchase of a site and fixed assessment in connection with the proposed picture frame factory.

St. Thomas, Ont.

The Royal Bank of Canada has purchased a building and will adapt same for bank, offices and apartments.

Toronto, Ont.

S. A. N. Powell, 617 Spadina Ave., proposes to erect a theatre and stores on Yonge street, frontage 120 ft., at corner of Grenville Street.

Plans are in progress for the erection of three stores and offices on St. Clair and Yonge, for Geo. L. Thompson, 446 Markham St.

The transfer of the license of Widmer Hotel to 71-3 Queen W., has been granted to H. Jackman, cor. Bay and Adelaide St., who will make the necessary alterations and repairs amounting to \$25,000.

The Women's Art Assn. of America, 594 Jarvis St., are planning to raise funds for erection of new building.

The erection of stores, etc., on St. Clair Ave. and Prescott St., is contemplated by Weismiller & McKenzie Bros., 1381 Queen St. West.

Vancouver, B.C.

I. G. Haekel, Hotel Vancouver, managing director of Commercial Cars, Ltd., Luton, Eng., is looking for a suitable site for the erection of a motor truck factory.

Windsor, Ont.

Plans are being drawn for Windsor Hotel Co., by J. W. Wilson, Penabsat Bldg., Detroit, Mich., for an 8-storey \$300,000 hotel at the corner of Ouellette and Park streets.

The Windsor Jockey Club propose making a concrete and steel 120 ft. addition to the grandstand.

Winnipeg, Man.

Plans are being prepared for a store and office building for J. Craig, by C. S. Bridgman, 20 Canada Life Bldg.

Superior Bldg., Ltd., 421 McIntyre Block, will probably erect a \$60,000 apartment block on Young St.

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CONTRACTS AWARDED

Ford City, Ont.

The following additional contracts have been awarded in connection with the Sandwich St. E. branch of the Merchants Bank of Canada. General contractors, Wells & Gray, Windsor; steel, Canadian Bridge Co., Walkerville; roofing, Pennington & Brian, Windsor; painting, C. M. Bennett, Walkerville; heating and plumbing, Jos. L'Heureux, Wyandotte St., Windsor.

Montreal, Que.

C. E. Deakin, 41 Mayor St., who has the contract for the Power Bldg., cor. of St. Lawrence and Ontario Streets, has sub-let the following contracts: Architectural iron, F. A. McKay, 18 St. George St.; heating and plumbing, W. J. McGuire, 332 Craig W.

A contract has been awarded for alterations to picture theatre on King St. to Messrs. Heon, Roy & McLeod, care R. Gariepy, architect, 25 St. James St.

Ottawa, Ont.

The following additional contracts have been awarded in connection with the theatre on Bank St. for W. Herbert George, architect, Castle Bldg., Queen St.; carpentry and electrical work done by day labor; galvanized iron and roofing, McFarlane & Douglas, 250 Slater; plastering, Murphy & Morrow, 139 Waverley; heating and plumbing, J. R. McLennan, 240 Bank.

Peterboro, Ont.

The following contracts have been awarded on the Turnbull Bldg.: General contractors, Wm. Langford & Son, Peterboro; heating, J. A. C. Duranceau, 227 Hunter St.; wiring, F. R. J. Macpherson, 341 George St.

Toronto, Ont.

The contract for the factory of the Five-in-one-letter-Envelope Co., on Hayter St., has been awarded to S. L. Yolles, 46 Cecil St.

The contract for the warehouse for H. Greisman on Richmond and Duncan Sts., has been awarded to Standard Structural Co., Manning Chambers. Architects, Chadwick & Beckett, 18 Toronto street.

Windsor, Ont.

The following contracts have been awarded by the Windsor Ice Storage & Forwarding Co.; Architect and general contractor, Thos. Z. Humphries, Royal Bank Bldg.; ice mfg. machinery awarded to Canadian Ice Machine Co. of Toronto; representatives of York Mfg. Co., of York, Pa.

Residences

Cedar Springs, Ont.

Tenders are to be called shortly for an \$8,000 residence for James McCuigan. Architects, Jas. L. Wilson & Son, 64 Market Bldg., Chatham.

Hamilton, Ont.

M. Chertkoff, 60 Locomotive Street, is looking for suitable site for the erection of a \$15,000 apartment building.

London, Ont.

Wm. Copp, 83 Byron Ave., is drawing plans for the erection of two residences at a cost of \$8,000.

J. H. Bach, 52 Riverview Ave., has

plans in progress for the erection of a residence at a cost of \$8,000.

The erection of five residences to cost \$18,000 is contemplated by Jas. Stevenson, Kilworth, Ont.

Morley Aylesworth, 17 Victor St., is drawing plans for the erection of a \$10,000 residence.

Middleton, N.S.

The erection of a residence and office building on Main St. is contemplated by Dr. A. C. Fales; the probable architects is L. R. Fairn, Aylesford, N.S.

Montreal, Que. (Outremont)

Separate tenders will be received by W. E. Doran, 189 Bleury St., architect, from Feb. 20th to 30th, for the erection of a residence on St. Catherine Road for J. Clark.

Nanton, Alta.

A. E. Cross is considering the erection of a \$15,000 residence 14 miles west of this point. Work is to be done by day labor. Architects, Lang & Major, Board of Trade Bldg., Calgary.

Ottawa, Ont.

The sum of \$75,000 for gas and electric lights for roads and bridges was included in the estimates for 1914.

Plans are in progress for a \$18,000 residence on O'Connor and Linden Sts., for G. F. Hodgins, 344 Frank St.; the architect is W. E. Noffke, Central Chambers, who will call for tenders shortly.

The following committee has been appointed to report at the next meeting of the Carleton County Council in regard to additions and alterations to Court House and caretakers' apartments: Warden Honeywell, Councillors Ormrod, Wolmer and Hill, County Bldg.

The erection of a \$6,000 residence is being considered by Calib Brooks, Driveway West.

Sherbrooke, Que.

Plans are being drawn by H. G. James, 4 Magog St., for residence to cost \$7,500, for Chas. D. White.

Toronto, Ont.

Plans for detached residences on St. Andrews Gardens and Summerhill Ave., have been drawn for Robt. Doherty, 39 St. Andrews Gardens.

Sketches for a residence on Woodlawn Ave., for Thos. Mix, are being drawn by G. M. West, 2 College St.

Tenders for alterations and addition to residence at Rosedale will be received by F. S. Baker, Royal Bank Bldg., until noon, February 27th.

Windsor, Ont.

Plans have been drawn for 15 residences on Marion Ave., for V. St. Louis, by Daniel Cascadden, architect.

Winnipeg, Man.

The Daykin Scott Construction Co. are about to erect an \$8,000 residence on Florence street.

P. N. Clemens, architect, 331 Garry St., is drawing plans for a \$65,000 apartment block on Maryland Street for Albert Johnson, 522 Union Bank Bldg.

CONTRACTS AWARDED

Brockville, Ont.

The following contracts have been awarded on the alterations to apartments, \$7,000, for Mrs. W. J. McHenry; architect, A. Stuart Allaster; painting, John Square, Lyn, Ont.; plumbing and heating, Geo. Ross & Co.; electrical, A.

G. Dobbie & Co.; other trades to be done by day labor.

Hamilton, Ont.

Contract for six residences, on Balsam, has been awarded by A. Hines, 21 Barton W., to R. Press & Son, 142 Ferguson Ave. N.

Montreal, Que.

The contract for the erection of Mr. Aronson's residence on Villeneuve St., has been awarded to Heon, Roy & McLeod.

Montreal, Que. (Outremont)

The contract for a residence on Querbes St., for Miss L. T. Cohan, has been awarded to Bonnell Bros., 341 Guy St. Architects, E. & W. S. Maxwell, 6 Beaver Hall Sq.

Montreal, Que. (Westmount)

The roofing contract of the residence on Grosvenor St. for Jno. H. Hand, 609 Belmont St. has been awarded to D. Nicholson & Co., 679 St. Paul.

Toronto, Ont.

The following contracts have been awarded in connection with the residence on Forest Hill Rd., for Dr. E. M. Hooper, 61 DeLisle St. Masonry, Thomas Bros., 420 Dupont St.; carpentry, N. Oliver, 16 Roslin Ave.; plumbing and heating, A. F. Passmore, 428 Yonge St. Other contracts not yet awarded.

Vancouver, B.C.

A contract has been awarded for two residences on Shaughnessy Heights for C. P. R. (Land Dept.), Vancouver Bldg., to S. J. Newitt, 954 17th Ave. W. The contract includes all trades but plumbing and sewerage.

Winnipeg, Man. (Point du Bois)

A contract has been awarded by the City Council to Canadian Allis-Chalmers, Ltd., 146 Notre Dame Ave., for head gate and head gate lifting mechanism and other auxiliary apparatus for power plant at \$3,440.

Power Plants

Burford, Ont.

The ratepayers will vote on March 9 to authorize the council to contract for hydro power.

Bassano, Alta.

All tenders received by Town Council for telephone line were unsatisfactory. New tenders will be called later.

Brantford, Ont.

Jas. E. Walsh, general manager of the

(Continued on page 85)



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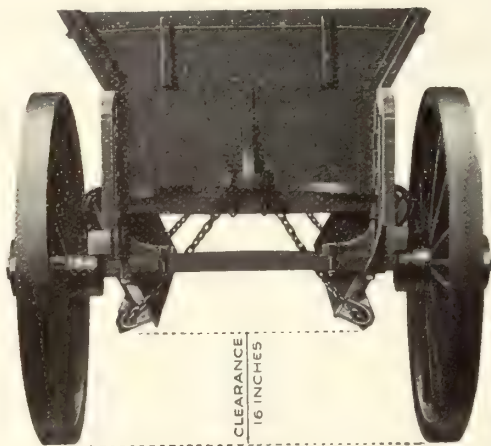
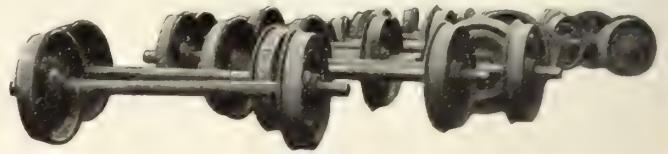
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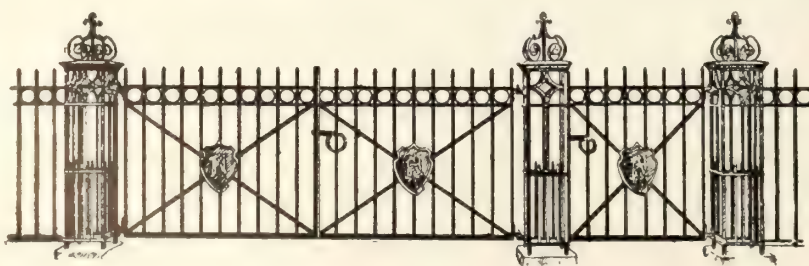
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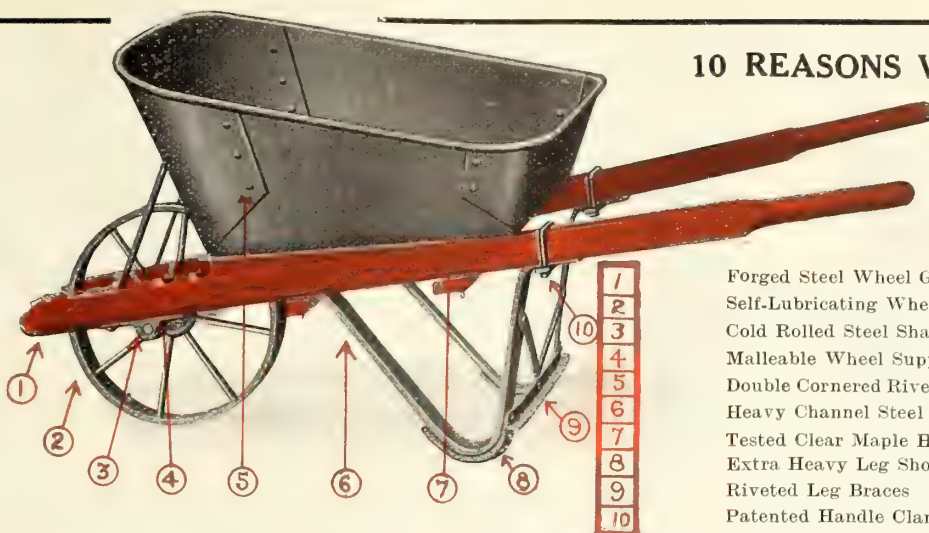
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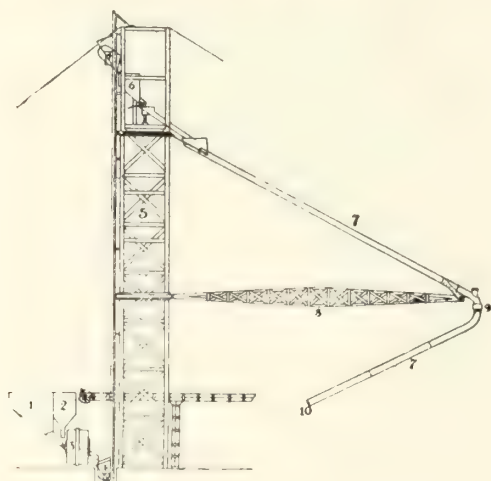
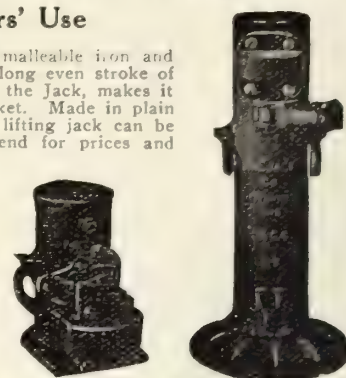
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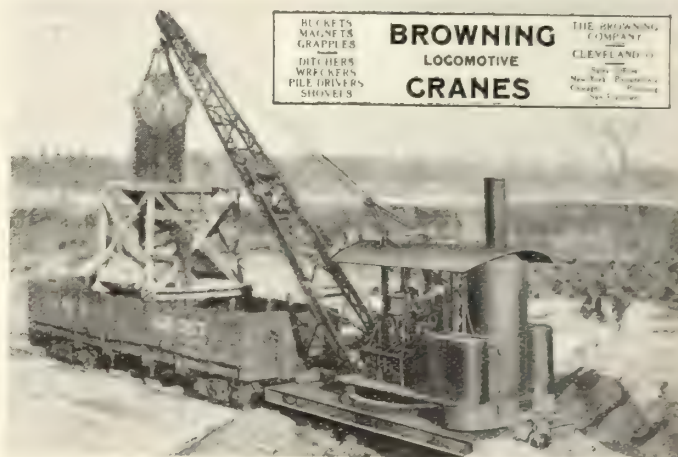
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Power Supply Co. of Detroit, Mich., and representative of the Canadian Crate & Supply Co., is negotiating with the town for a suitable site.

Drumbo, Ont.

Ratepayers at Drumbo, Glassville and Princeton, passed a by-law for Hydro Electric Power.

Galt, Ont.

Electric fire alarm system will likely be installed by the town council, also additions made to fire fighting apparatus, including steam fire engine.

Hamilton, Ont.

Tenders will be called by the Dominion Power & Transmission Company about Feb. 18th, until 28th, for cold storage building, with elevators and crushing apparatus, boiler room, turbine and engine rooms, transformer buildings and offices. The estimated cost is \$3,500,000. Engineer in charge, W. G. Angus, Terminal Station. Architects, Prack & Perrine, 36 James St. S.

Havelock, Ont.

The Town Council has requested the Hydro-electric Commission to send information re lighting and power question.

London, Ont.

Six new street cars will be purchased by the London Street Railway Company, Thames Street.

Moncton, N.B.

At a recent meeting of the City Council a committee consisting of Ald. Tingley (chairman), Robinson and McAnn, was appointed to confer with Chief Engineer J. Edington and City Solicitor C.

A. Steeves, and to prepare plans and specifications for a proper system of street lighting where permanent work is to be done. The committee will submit plans and specifications to Moncton Tramways, Electricity & Gas Co., Ltd., for agreement as to installation and power for lighting same and report at first council meeting in March.

Ottawa, Ont.

The sum of \$60,000 for re-wiring government and department buildings was included in the estimates for 1914.

The sum of \$35,000 for fire protection for parliament and department buildings was included in the estimates for 1914.

Plattsville, Ont.

The Village Council having passed the by-law for hydro electric lighting. Poles wire, meters, etc., will be required.

Regina, Sask.

The following items have been approved by the City Council (Light & Power Dept.): Service and fire alarm wiring, \$4,500; pole line hardware, \$4,200; secondary wiring, \$15,500; transformers, \$13,200; meters, \$22,000; main switchboard and feeder regulator, \$22,000; two 125-kw. exciters, \$12,000.

Sydney, C.B.

The City Council is considering the installation of a 2-unit pumping system addition to the present service, to be operated either by steam or electricity.

Woodstock, Ont.

F. Crossley and John Harrison, the wardens of Old St. Paul's Church, will receive tenders for electric wiring and fixtures until March 5th.

CONTRACTS AWARDED

Lacombe, Alta.

The electric railway contracts have been awarded by the Lacombe & Blindman Valley Electric Co., as follows: Tithes, Scott & Yeager, Lacombe; steel, Gorman, Clancey & Grindley Co., 752 4th St., Edmonton. 37 miles of railroad to be constructed; 18 miles will be let in about two weeks and balance in spring. One engine and one car required in spring. Engineers, Farncomb & In-saker, Sheppard Block.

Toronto, Ont.

The Commissioner of Works recommends the awarding of a contract to the Toronto Hydro-electric System for one 25-kilowatt transformer at \$206.80, also contract to Canadian Westinghouse Co. for 24 coils with insulation for 1500 h.p. motor for use at Main Pumping Station.

Miscellaneous

Calgary, Alta.

The City Commissioners have recommended to the council that a contract be awarded to General Supplies, Ltd., 122 11th Ave. W., for 10,000 ft. lead covered paper insulated underground electric cable.

Fredericton, N.B.

Tenders will be received at the Public Works Department, Fredericton, until noon, Feb. 20th, for 530 running feet of steel fence with gates and fitted electric lamp posts for Normal School. To be completed not later than August 1st, 1914. Plans and specifications at Dept., Fredericton.

CONTRACTORS' LOCOMOTIVES



The Locomotive illustrated was built for MacKenzie, Mann & Co., Contractors, Montreal, Canada, and represents the latest development in this type of locomotive.

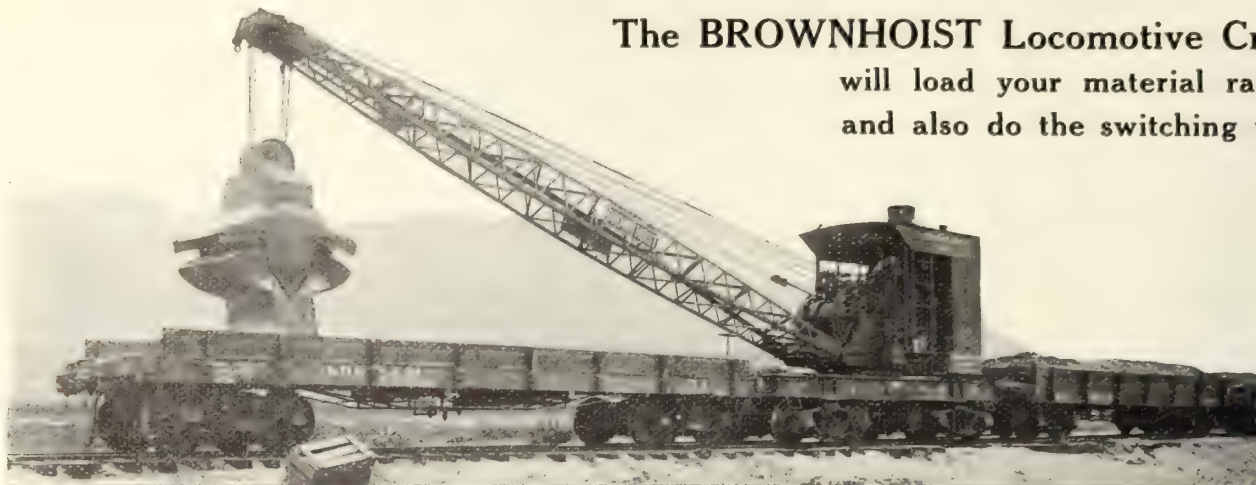
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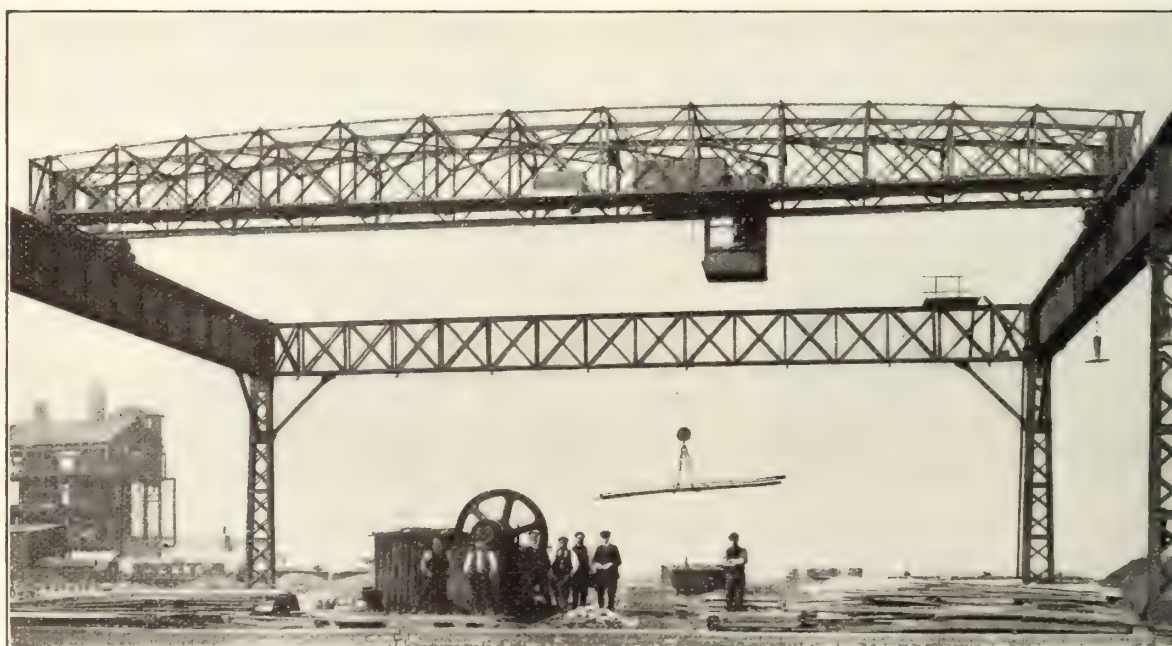
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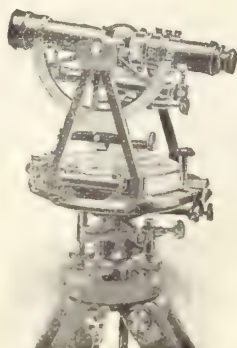
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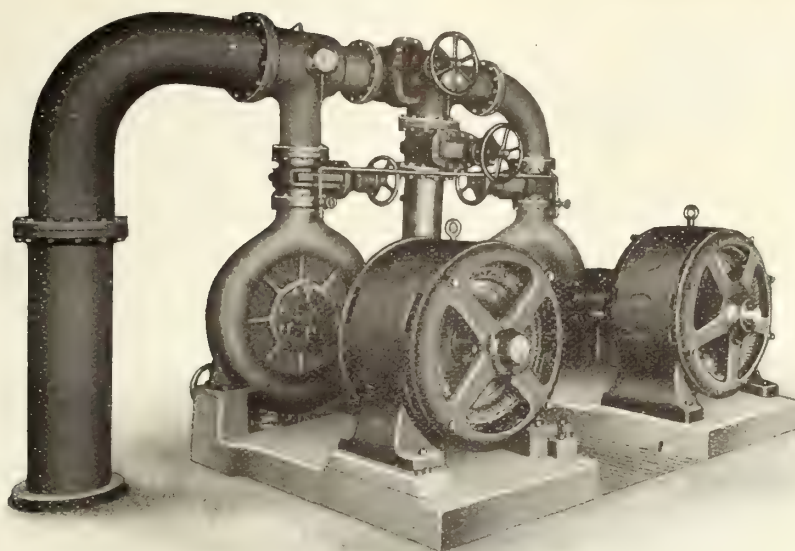
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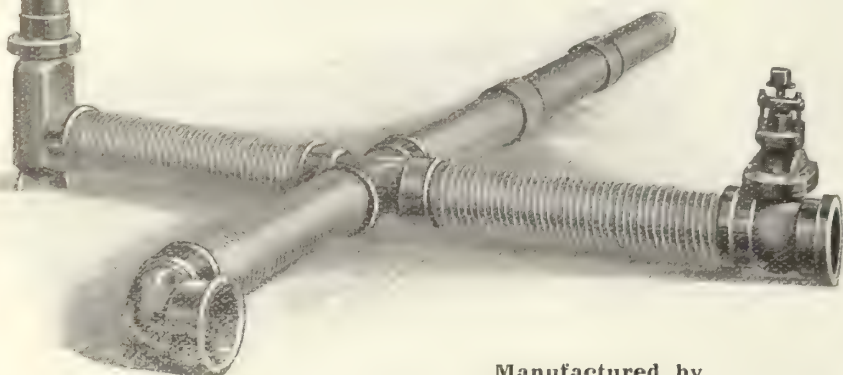
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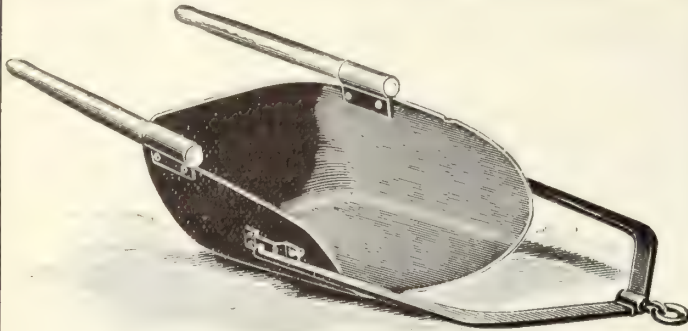
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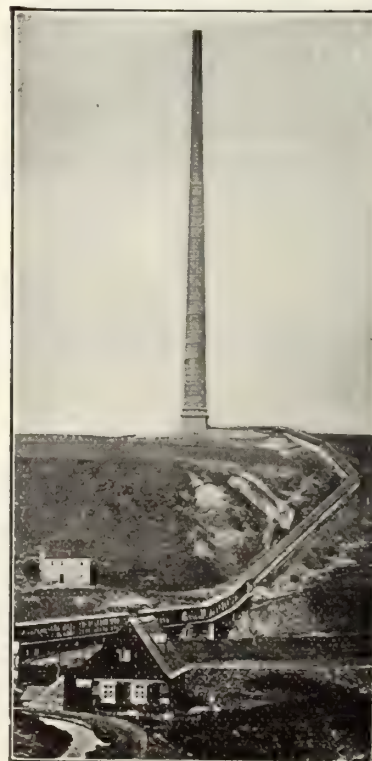
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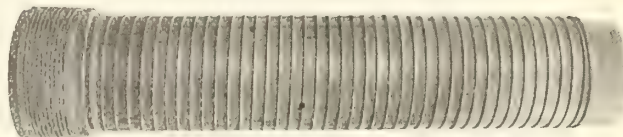
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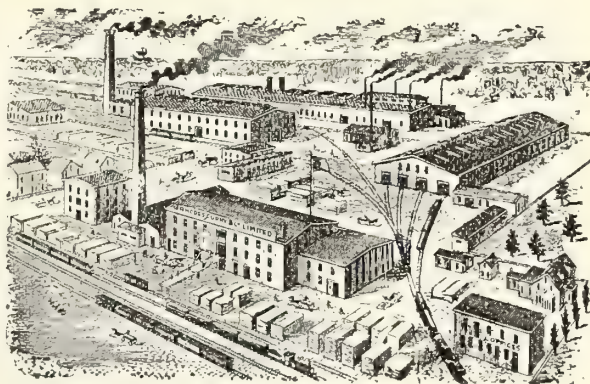
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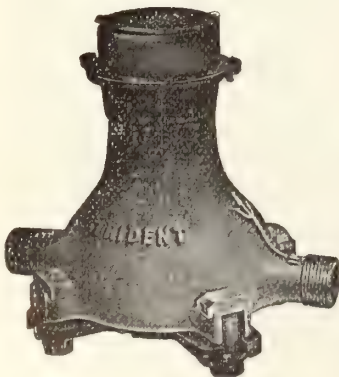
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To correct the erroneous impression that our business operations are confined to the immediate vicinity of our Des Moines Plant, it has become advisable to change the name of the Des Moines Bridge & Iron Company to

Pittsburgh-Des Moines Steel Company which more correctly describes the location of our company and our field of operation.

There has been no change in the management.

We are prepared, with enlarged facilities and new equipment at both our Pittsburgh and Des Moines Plants, to handle our Steel Water Tower and Structural Steel business in an even more satisfactory and prompt manner than in the past.

We solicit your enquiries and patronage.

Pittsburgh-Des Moines Steel Company

formerly—Des Moines Bridge & Iron Co.

Pittsburgh, Pa. 945 Curry Bldg.

New York City 50 Church St.

Des Moines, Ia. 938 Tuttle St.

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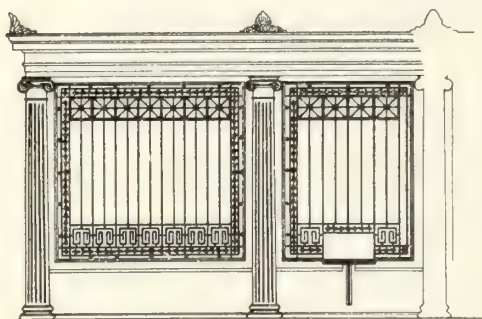
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Two New Sizes

Size in inches	$\frac{5}{8}$	$\frac{3}{4}$
Links per foot	6	$5\frac{1}{3}$
Weight 100 ft.	410 lbs.	600 lbs.
Proof Test	13,000 lbs.	18,000 lbs.
Breaking Test	26,000 lbs.	36,000 lbs.
Working Load	8,000 lbs.	11,000 lbs.

Made in
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25%
Stronger

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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stand all these conditions and have been successfully used for years on the largest penstocks in the world, not only in Canada, but in the United States, South America, Mexico,—in fact, the world over. Their PROTECTIVE VALUE and ULTIMATE ECONOMY has been proven time

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White Oak Timbers

We Offer for Sale from Stock Here the Following
Lot of A-1 Grade Oak Timber

Length	Size	Length	Size	Length	Size	Length	Size
60 ft.	12 in. x 15 in.	23 ft.	13 in. x 14 in.	52 ft.	13 in. x 14 in.	38 ft.	12 in. x 14 in.
41 ft.	18 in. x 20 in.	33 ft.	15 in. x 15 in.	51 ft.	18 in. x 19 in.	31 ft.	13 in. x 13 in.
40 ft.	19 in. x 20 in.	43 ft.	18 in. x 19 in.	48 ft.	15 in. x 16 in.	31 ft.	14 in. x 16 in.
32 ft.	12 in. x 15 in.	60 ft.	14 in. x 15 in.	44 ft.	14 in. x 15 in.	35 ft.	14 in. x 15 in.
24 ft.	15 in. x 16 in.	44 ft.	18 in. x 18 in.	43 ft.	18 in. x 19 in.	39 ft.	18 in. x 18 in.
34 ft.	12 in. x 14 in.	43 ft.	16 in. x 16 in.	34 ft.	13 in. x 13 in.	41 ft.	17 in. x 18 in.
25 ft.	14 in. x 14 in.	38 ft.	13 in. x 15 in.	30 ft.	14 in. x 15 in.	42 ft.	16 in. x 18 in.
28 ft.	14 in. x 13 in.	41 ft.	12 in. x 13 in.	21 ft.	15 in. x 16 in.	41 ft.	14 in. x 15 in.
32 ft.	12 in. x 14 in.	37 ft.	13 in. x 14 in.	23 ft.	19 in. x 20 in.	38 ft.	13 in. x 14 in.
28 ft.	16 in. x 16 in.	43 ft.	16 in. x 16 in.	29 ft.	17 in. x 19 in.	27 ft.	14 in. x 17 in.
29 ft.	16 in. x 16 in.	47 ft.	16 in. x 17 in.	34 ft.	14 in. x 15 in.	44 ft.	14 in. x 15 in.
31 ft.	14 in. x 13 in.	43 ft.	15 in. x 16 in.	35 ft.	14 in. x 17 in.	40 ft.	13 in. x 13 in.
33 ft.	13 in. x 14 in.	39 ft.	14 in. x 14 in.	35 ft.	15 in. x 15 in.	41 ft.	13 in. x 14 in.
33 ft.	13 in. x 14 in.	41 ft.	13 in. x 15 in.	31 ft.	12 in. x 13 in.	39 ft.	13 in. x 13 in.

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5 Floors of This New
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and Warehouse Use.

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When completed this will be the most attractive warehouse building in the city. The exterior, the entrances, the elevators, etc., bear all the earmarks of a high class office building.

Special Features

Centrally situated
Light on four sides
Passenger and freight elevator
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One block from four car lines
Floor area, 6,300 sq. feet, each floor.

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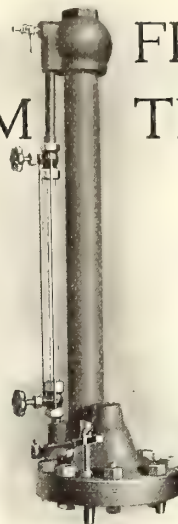
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COMBINES COMPACTNESS, GREAT DURABILITY and PERFECT OPERATION UNDER ALL CONDITIONS

THIS TRAP

Will handle water at any temperature.
Works at any pressure below maximum without readjustment.
Is not affected by vibration or oscillation (hence well adapted to marine work.)
Is adapted to the highest pressures.
Is entirely free from wire-drawing action as valve is either wide open or closed.

ALL adjustments are made from outside the trap and the valve may be held wide open for blowing out by a simple movement of a lever. Its only moving parts are a diaphragm, valve of phosphor bronze, and a steel spring, coated to prevent rusting. The casings are all of the best grade close grained iron. It may be equipped with a gauge glass to indicate the amount of water always in the trap.

This trap is especially adapted for draining cylinder jackets of engines and for use in restricted spaces.

Bulletin 137-Z gives additional information in regard to this trap.

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919 New Birks Building, Montreal

Selling agents for Sanford Riley Stoker Co., Ltd., "The Riley Stoker"

Current Prices of Building and Engineering Materials

BRICKS

The following are wholesale prices delivered at Toronto:—

	Per M.
No. 1 dry pressed red brick	\$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Brick	13 00
Grey Stock Brick	12 00
Wire cut brick for foundation work	11 00
Porous terra cotta brick	15 00
No. 1 enamelled brick, all colors, from	\$80 00 to \$150 00
Sand-Lime Brick (King Edward Siding)	8 10

LUMBER (Building Material)

Hemlock Lumber—	
2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	\$26 00
2 x 4 to 2 x 12, 16 ft.	26 00
2 x 4 to 2 x 12, 18 ft.	29 00
1 in. Hemlock, No. 1	25 00
No. 1 Hemlock Decking	25 00
No. 2 Hemlock dimension and 1-in.	19 00

Pine—	
1 in. common pine 8 to 12 in. wide rough	26 00
2 in. white pine Bill stock	29 00
¾ x 8 and 10 in. pine shelving	36 00
¾ x 12 in. pine shelving	45 00
No. 1 white pine flooring	33 00
No. 1 spruce flooring	28 00
No. 1 pine decking D2S	30 00
Spruce Decking	28 00
No. 1 pine V. or headed sheeting	36 00
No. 2 pine V. or headed sheeting	32 00

Pine trim for paint finish—	
4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8 in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—	
XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—	
5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:	
8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50
8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$ 6 25
26 to 40	4 60	6 75
41 to 50	5 10	7 50
51 to 60	5 35	8 50
61 to 70	5 75	9 75
71 to 80	6 25	11 00
81 to 85	7 00	12 50
86 to 90		15 00
91 to 95		17 50
96 to 100		20 50
101 to 105		24 00
106 to 110		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	\$3 25	\$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	\$3 60	\$5 00
26/40	3 75	5 60
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 65 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 70 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net\$1.85
No. 4½ Fuller's net\$2.35
Square head brass cocks, 65 and 5 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6¼ cents per lb.; traps and bends, 40 per cent.; pig lead, 6¼ cents per lb.

Iron Pipe

Size (per 100 ft.)	Black	Galvanized
¼ inch	\$2.16	¾ inch \$3.06
½ " "	2.16	¾ " " 3.06
¾ " "	2.64	¾ " " 3.57
1 " "	3.05	¾ " " 4.20
1 ½ " "	4.51	1 " " 6.21

1¼ " "	6.19	1¼ " "	8.40
1½ " "	7.29	1½ " "	10.04
2 " "	9.81	2 " "	13.51
2½ " "	16.80	2½ " "	21.65
3 " "	20.66	3 " "	28.31

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 and 10 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in. 25c ft.	15-in. 1.40 ft.
6-in. 40c ft.	18-in. 1.90 ft.
9-in. 70c ft.	20-in. 2.25 ft.
12-in. 1.00 ft.	24-in. 3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.

Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; ¾-inch, \$1.45.

Burnt River rubble stone delivered, \$16 to \$17 per ton.

Plain steel bars, \$2.25.

Square twisted bars, ¾ to 1¼, \$2.35.

Malleable fittings — Canadian discount, 45 and 42½ per cent.

Free stone delivered, \$15 to \$18 per ton.

Brown coursing stone, delivered, \$3.75 per yard.

Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.

Sand, for cement or brick work, \$1.20 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 85c to \$1.00 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, \$1.30 per ton.

Steel channels and beams, angles and plates, \$2.55 to \$2.90 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded, from \$8.00 to \$8.50, bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, \$1.30 bbl.

Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, \$8.75 per 100 lbs.

Boiled Linseed Oil in bbls., 65c per gal. of 9 lbs.

Raw Linseed Oil, in bbls., 62c per gallon.

Pure Red Lead, dry, \$7.00 to \$8.00 per 100 lbs.

Putty, pure linseed oil, in bulk, bbls., 3¼c.

Putty, pure linseed oil, in 25-lb. tins, 4c.

Turpentine in bbls., 66c.

ERIE

This "Erie" concrete barrow No. 26 has a welded tray made without rivets. It is watertight and cannot burst open. Well braced channel iron legs; wheel guarded; forward or side dump.



Concrete Barrow

This barrow No. 34 has a welded tray, no rivets and is absolutely watertight. Wheel guarded and has forward or side dump. WRITE US.



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RAILS**BILLETS****Concrete Reinforcement Bars**

Plain Round, Square and Cold Twisted Squares

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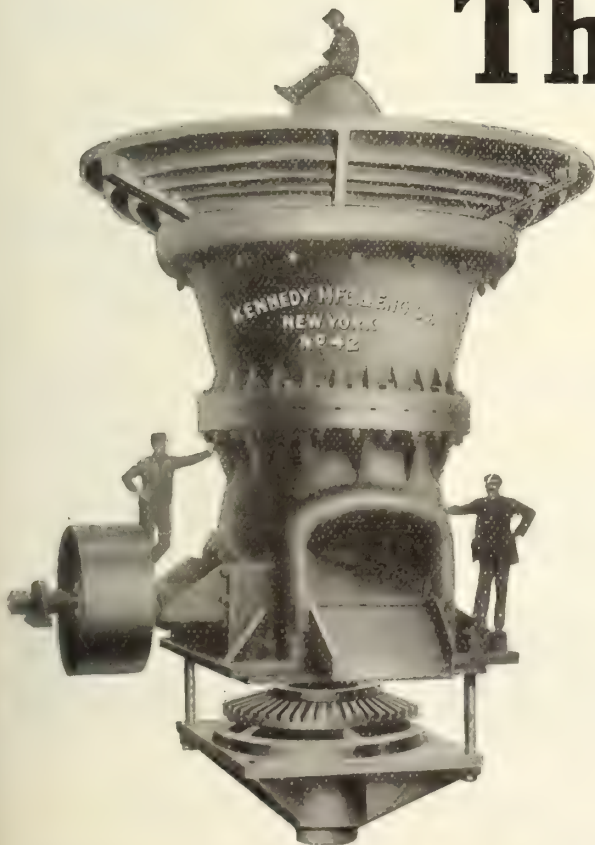
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There are 14 fundamental reasons why this crusher was selected.

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Rock Drills for every requirement.

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For water works systems, domestic water supply and hydraulic mining. Insulated wire conduits; steam pipe casings; acid-proof pipe for mines, tanneries and pulp mills. Sizes from 2 inches to 24 inches.

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of Waterworks Supplies.



3 inches to 60 inches diameter

for Water, Gas, Culvert and Sewer

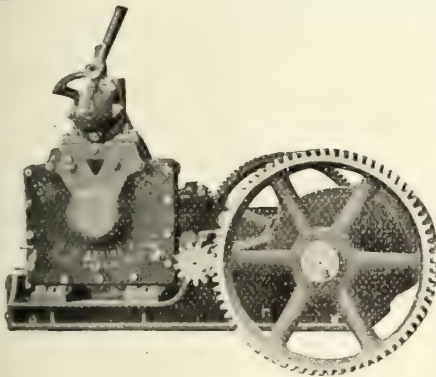
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in Sawn Slabs

as well as Rough Quarried Blocks, Dimension
Blocks and all forms of Cut Stone such as Sills,
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Hard Wall Plaster

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for Interior Construction

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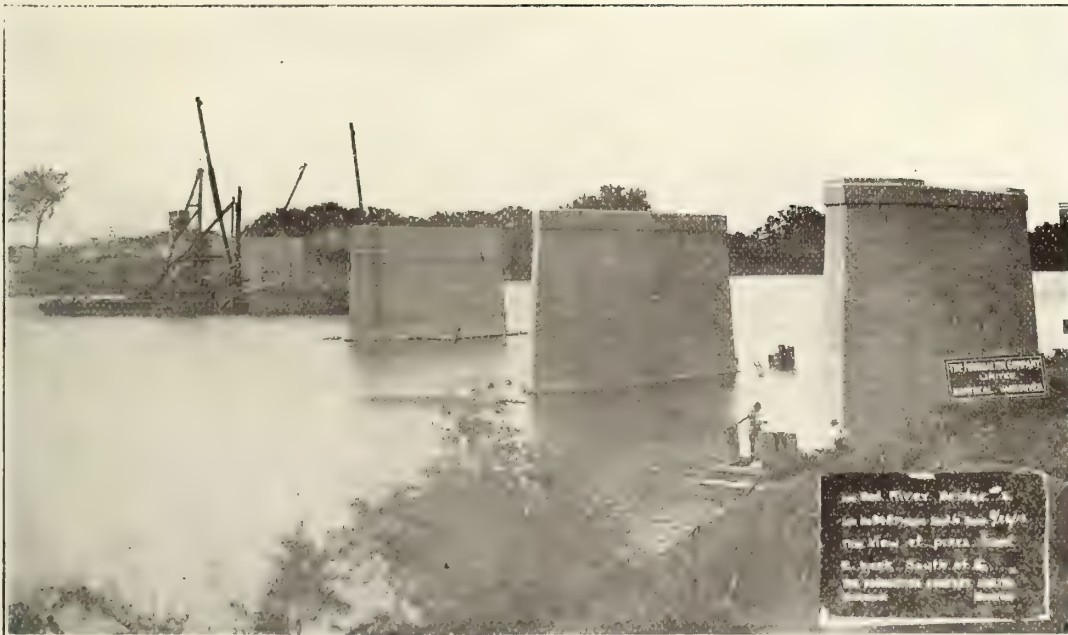
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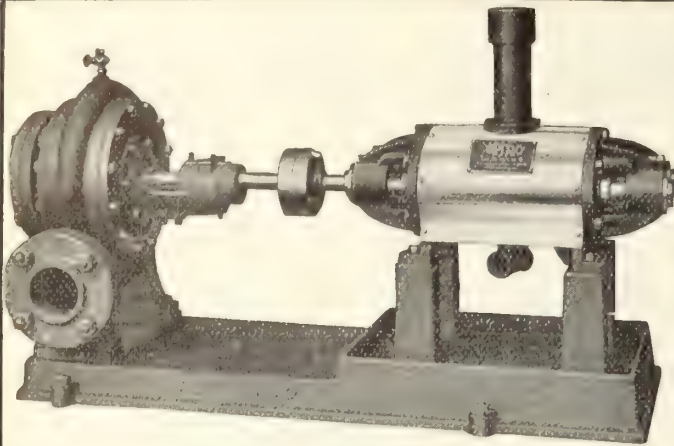
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Our experienced organization, which is second to none in North America, enables us to successfully execute the most difficult foundation work in the speediest and most economical manner.



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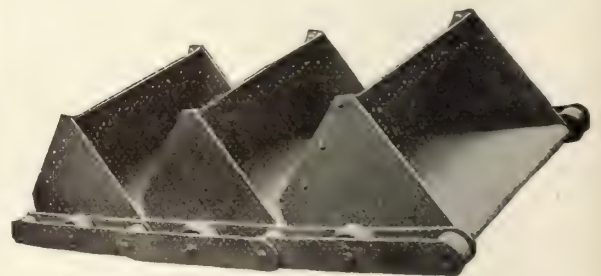
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For the contractor who is handling large quantities of sand, stone, gravel, and other rough material, a Waterous Steel Bucket Elevator will effect economies in time and labor that are worth consideration.

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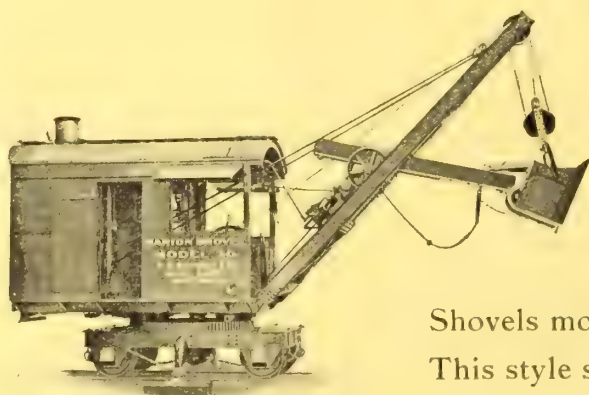
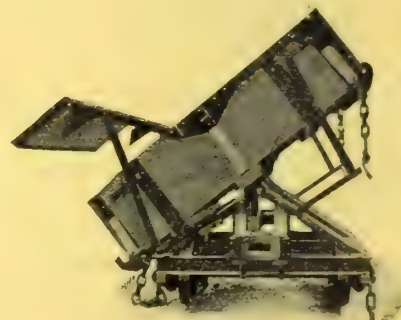
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All sizes for any practical gauge

We will be pleased to submit full particulars.

Dump Cars

We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.



“MARION” STEAM SHOVELS

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This type shovel is supplied in three sizes
5/8 - 1 and 1 1/2 cu. yd. capacity

Shovels mounted on Traction Wheels or Railroad Trucks.
This style shovel is specially adapted for Brickyards—Mines
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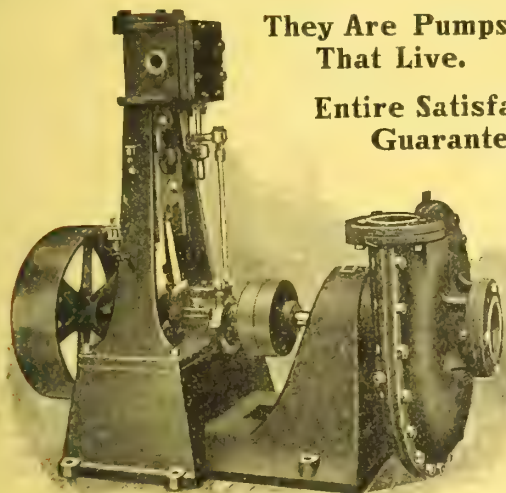
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One-half the cost of Iron Pipe—
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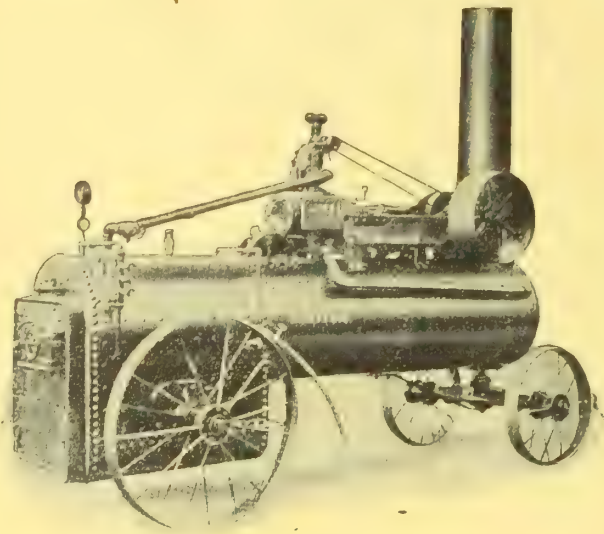
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We also build Boilers, Air Compressors, Engines, Derrick Engines, Hoists of all kinds, Crushers, Screens, etc.

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This Crane Solves The Problem of Economical Material Handling In Storage Yards

The handling and storing of heavy materials: lumber, structural steel, heavy iron pipe, tile, stone etc., is bound to be slow, laborious and expensive—until you install an

"AMERICAN" STEEL STORAGE CRANE

then it becomes speedy, easy and economical.

The different lengths, sizes and qualities of material are kept separated and easily accessible. An "AMERICAN" Steel Storage Crane assures an orderly, well piled yard.

For handling coal, crushed rock, etc., we equip this crane with a four-line clamshell bucket. It has made some mighty fine low-cost handling records at this work.

Boom radius 60, 80 or 100 feet, as size of yard requires.

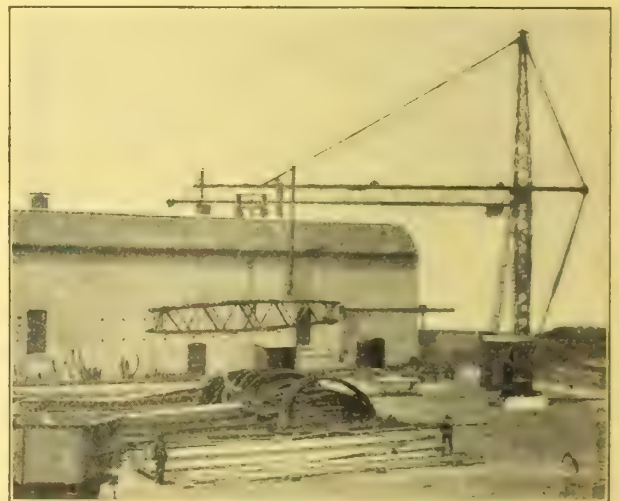
A letter to us now may mean a big saving in your storage yard expense.

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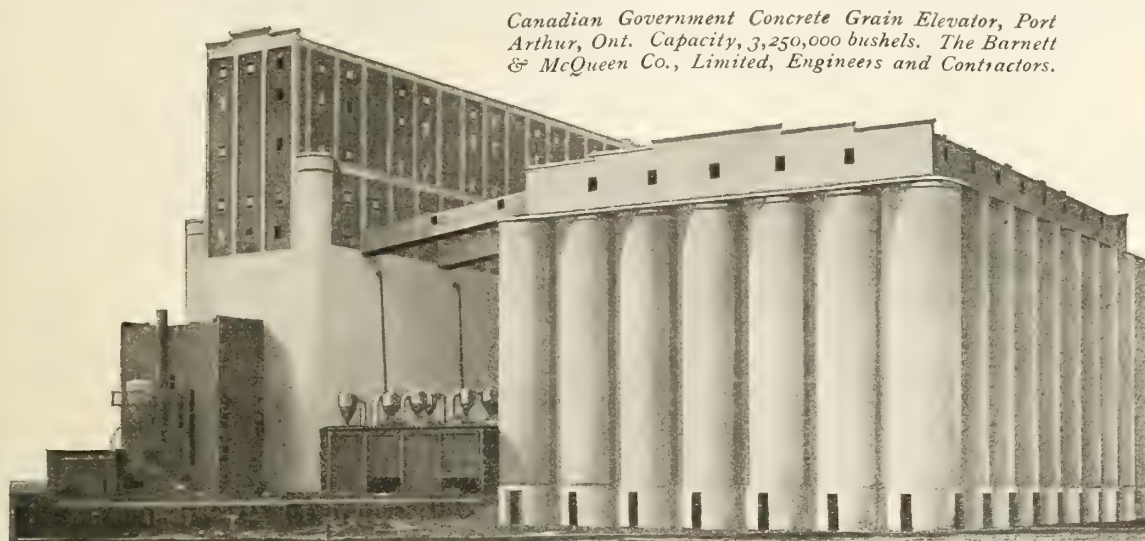
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Canadian Government Concrete Grain Elevator, Port Arthur, Ont. Capacity, 3,250,000 bushels. The Barnett & McQueen Co., Limited, Engineers and Contractors.

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The best evidence of the practicability and economy of concrete for the building of large structures, is contained in this illustration of the Canadian Government Concrete Grain Elevator at Port Arthur, Ontario.

The practicability and economy of concrete lie in its adaptability to any structural design, its great strength and its durability. It is unburnable, practically indestructible and

Minimizes Maintenance Cost

Concrete, on account of its adaptability affords unlimited possibilities in the design of all classes of structures. The fact that the greater part of the materials and labor that go into a concrete structure, may be obtained locally, makes its use economical and convenient from the viewpoints of both engineer and contractor.

Complete information about concrete structures will be sent to anyone interested, without charge. State nature of building on your postal card of request.

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Canada Cement Company

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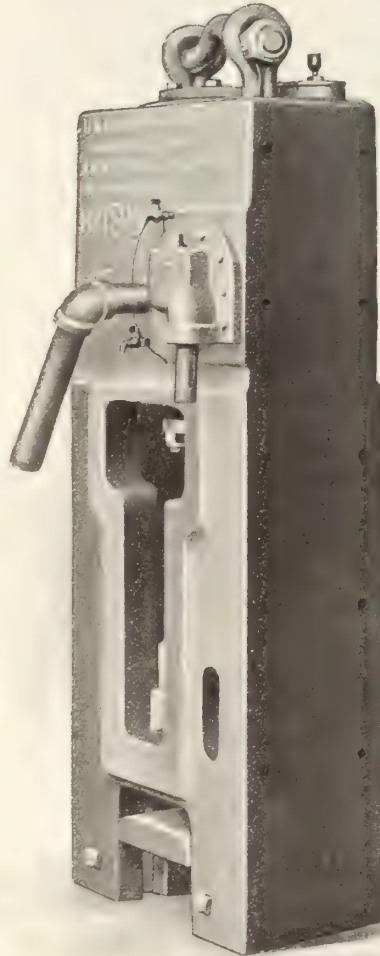
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By using the old fashioned drop hammer

The Union Pile Hammer

Will drive the big round wooden piles in one-tenth of the time.

The "Union" will drive anything that was ever attempted by old style equipment and it has many uses entirely its own.



For steam or air, in 10 sizes, offers the contractor the proven advantages of rapidity. Easier driving, deeper penetration, greatest resistance to damage of hammer or materials, saving in headroom, adaptability to lightest or heaviest work.

The "Union" will not damage the top of steel sheeting or of wooden piles. Put a "Union" on your next job.

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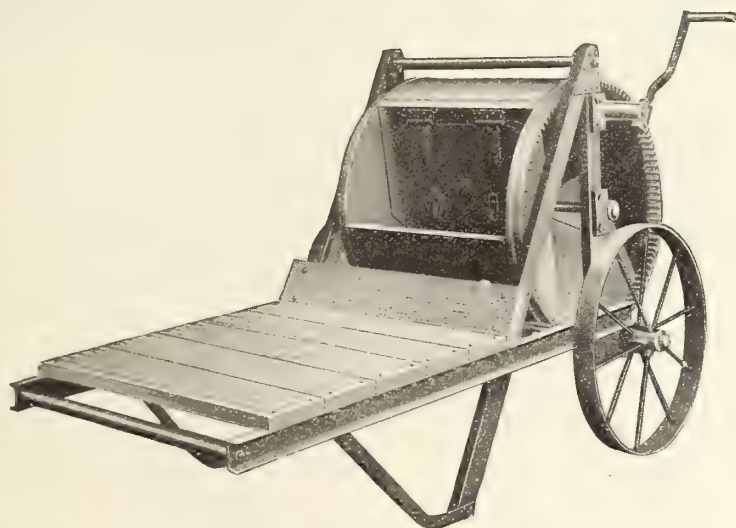
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The Smith Hand Mixer

Has no delicate mechanism to get out of order. You can work it as often and as hard as you like without fear of anything going wrong.



Capacity
25 to 30
Cubic Yards
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Efficient,
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The **Smith Hand Mixer** can be placed over the forms and it will dump right into position without wheeling or shovelling. Three slow turns of the drum gives a perfect mix.

Surprising results are obtained on sidewalks, telephone conduits, cement floors, bridges, culverts and small foundations.

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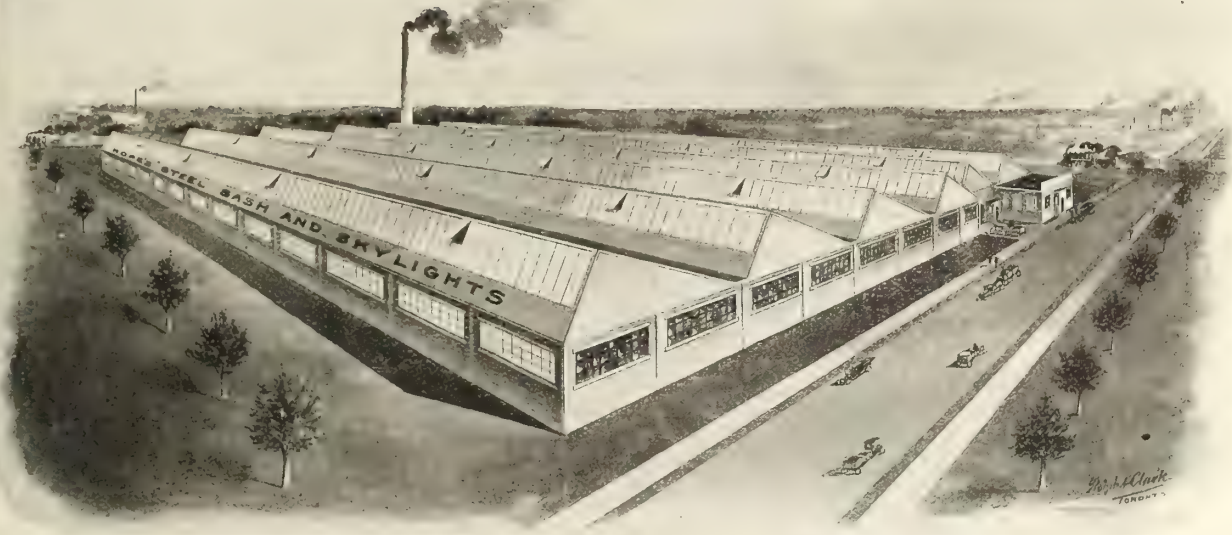
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¶ A striking example of the use of HOPE'S STEEL SASH and SKYLIGHTS for the Modern Factory Building.

¶ The interior of this factory is as complete and up-to-date as the exterior.

¶ Light and Ventilation to the fullest degree attainable is an important feature of the building.

¶ Machinery is all of the most improved type—specially designed for producing the very highest grade of Steel Sash in the most economical manner.

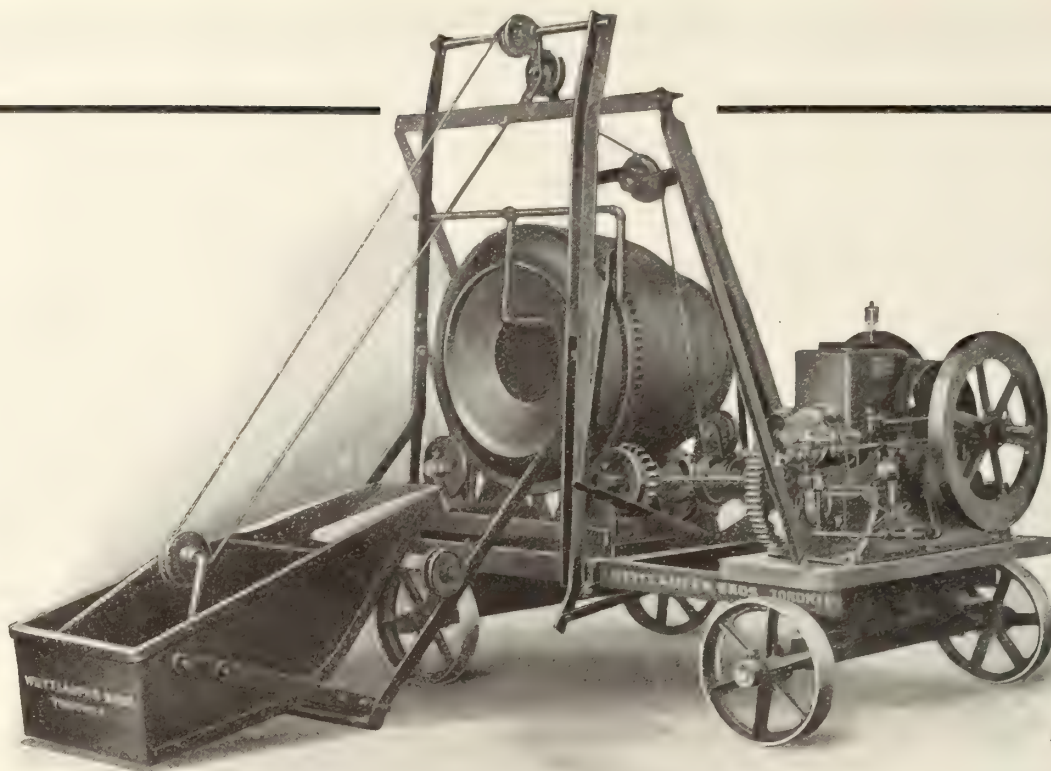
¶ The capacity and equipment of this plant will enable us to successfully execute all contracts and guarantee prompt deliveries.

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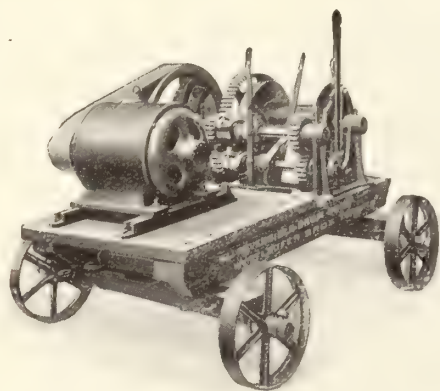
HENRY HOPE & SONS OF CANADA, LIMITED

43-45 King Street West, TORONTO

AGENTS: Peart Bros., Regina W. N. O'Neil & Co., Vancouver Aikenhead Clark Hardware Co., Winnipeg
Walker & Barnes, Edmonton Gandy & Allison, St. John, N. B. E. F. Stevens, Halifax David McGill, Montreal



Mixers and Hoists

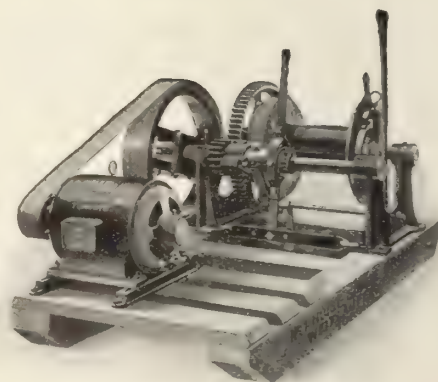


When it is time to buy new equipment be sure and examine the Wettlaufer line or Heart Shape Drum Mixers and Hoists.

Wettlaufer Mixers are famous the country over for their thorough mixing.

Wettlaufer Hoists are made in fourteen different types and sizes.

Attend a daily demonstration at any branch.



Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

AGENCIES:

A. E. Hodgert, Regina, Sask.; Maysmith & Lowe, 1057 Mears St., Victoria, B.C.; A. R. Williams Machinery Co., 15 Dock St., St. John, N.B.; The Canadian British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man.; R. F. Mancill, 117 10th Ave. East, Calgary; The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C.; J. L. Tachance, Ltd., 363 St. Paul St., Quebec; Wettlaufer Bros., 316 Lagachetiere St. W., Montreal.



Built for C.P.R. Montreal

Canadian Plant

Chicago Bridge & Iron Works, BRIDGEBURG, ONTARIO

Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

WRITE TO-DAY FOR CANADIAN ILLUSTRATED CATALOGUE NO. 15

OFFICES : 130 Janet St., Bridgeburg, Ont.
1360 W. 105th St., Chicago, Ill.

SHOPS : Bridgeburg, Ont.
Chicago, Ill.
Greenville, Pa.

There Are Over 1000 Thew Shovels In Operation

We would gladly tell you Why The Thew is so Popular for Road Construction and Street Grading. We would prefer to have you write to Contractors who are Using Thew Shovels on this class of work. Any of the following New York Road Contractors will tell you why they use Thew Shovels :

Joseph Walker, New Paltz, N.Y.
H. B. Sproul, Peekskill, N.Y.
S. B. Van Wagnen, Rondout, N.Y.
James E. Martin, Poughkeepsie, N.Y.
F. G. Fowler, Const. Co., Mt. Kisco, N.Y.
Brown & Lowe, Schenectady, N.Y.
Buckley Const. Co., Plattsburg, N.Y.
Newport Const. Co., Newport, N.Y.
Monroe Roads Co., Pittsford, N.Y.
Santanoni Const. Co., Newcomb, N.Y.
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Merritt Const. Co., Tuckahoe, N.Y.
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Jova & Kehoe, Newburgh, N.Y.
L. L. Melius, 2306 8th Ave., N.Y.C.
McGreevy, McGuigan & Baum, Elmira, N.Y.

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Ruddy & Saunders Const. Co., Troy, N.Y.
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Dale Engineering Co., Utica, N.Y.
Lyman A. Huntley, Syracuse, N.Y.
Paladino Contracting Co., N. Y. City.
M. A. Aldrich, Poughkeepsie, N.Y.
James Anderson & Sons Co., Albany, N.Y.
E. T. Beck, Cuba, N.Y.
Barber Asphalt Co., Buffalo, N.Y.
Joseph F. Stabell Co., Buffalo, N.Y.
Thomas Brown Const. Co., Buffalo, N.Y.
A. J. Rockwood, Rochester, N.Y.
F. C. Humeston, Brooklyn, N.Y.
H. P. Burgard, Buffalo, N.Y.
Eastern Concrete Steel Co., Buffalo, N.Y.
W. J. Burns Co., Rochester, N.Y.
Whitmore, Rauber & Vicinus, Rochester, N.Y.

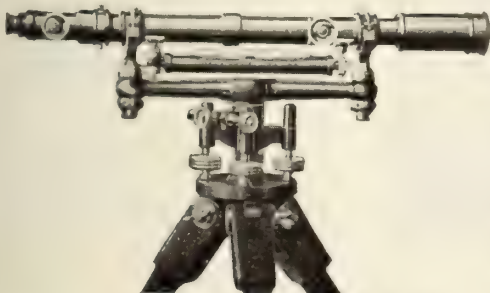
James Garafano & Sons, Mt. Vernon, N.Y.
Cunningham-Woodard Co., Hudson Falls, N.Y.
H. W. Roberts Co., Utica, N.Y.
Warner Quinlan Asphalt Co., Syracuse, N.Y.
H. R. Beebe, Utica, N.Y.
John F. Dolan, 50 Church St., N. Y. City.
German Rock Asphalt Co., Buffalo, N.Y.
Schunnemunk Construction Co., Highland Mills, N.Y.
DeGroff & Hogeboom, Kingston, N.Y.
Semper Bros., Watertown, N.Y.
Driscoll Bros. & Co., Ithaca, N.Y.
Gorsline & Swan Const. Co., Rochester, N.Y.
Miller & Knickenberg, Buffalo, N.Y.
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H. B. Cooper, Albany, N.Y.

Write For Catalogue and Detailed Information

THE THEW AUTOMATIC SHOVEL CO.

LORAIN, OHIO

GURLEY LEVELS



Standard
Since
1845

Accurate,
Dependable.
Hold their
Adjustment.

Four sizes, 15 inch to 22 inch.

W. & L. E. GURLEY, Troy, N. Y.
Branch Factory, Seattle, Wash.

AN OPPORTUNITY

Local Agents Wanted in
Quebec, Ottawa, Toronto, Winnipeg, Calgary,
Edmonton, Vancouver

Water Filters Refrigerating Machinery
1,000 to 1,000,000 Gallons a Day 1/4 to 60 Ton Daily Capacity
Water Purifiers
4 Gallons to 5,000 Gallons a Day

Refrigerators and Refrigerating Boxes for Ice or
Machine Refrigeration
Hotel, Restaurant and Saloon Equipment and Supplies

EQUIPMENT & SUPPLIES, LIMITED
302 MCGILL BLDG., MONTREAL, P. Q.

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

VITREOUS FACE BRICK



OUR BRICK SHOWROOM IN MAIL BUILDING

Keep the following Names
in Mind when Ordering
High Grade Brick.

Beaver Clay Mfg. Co.
Columbus Brick and
Terra Cotta Co.

Hydraulic-Press Brick
Co.

Hocking Valley Fire
Clay Co.

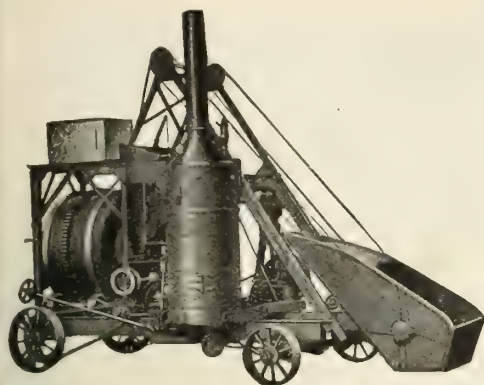
Kushequa Brick Co.

Ohio Mining & Mfg.
Co.

Pearl Clay Products
Co.

Tiffany Enameled
Brick Co.

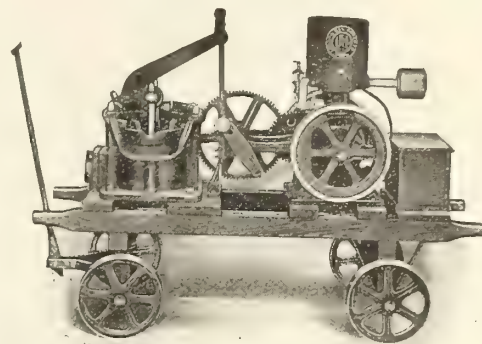
BLACK BUILDING SUPPLY CO., LTD. - TORONTO



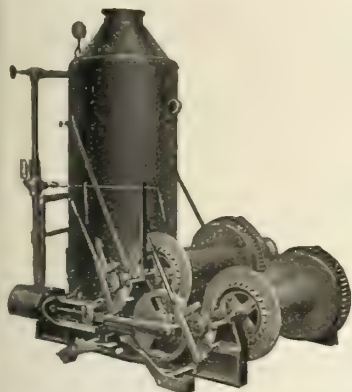
Rear Discharge Paving Machine with Forward Loader.

We are the largest manufacturers of Concrete Machinery in Canada.

We Cannot Afford to Make anything but the Best.



Diaphragm Pump with Power



Standard Hoisting Engine

CONCRETE MIXERS, MORTAR MIXERS, CONCRETE BLOCK MACHINES, CEMENT BRICK MACHINES, CEMENT TILE MACHINES, TILE MOULDS, ROCK CRUSHERS, PUMPING OUTFITS, HOISTS & DERRICKS

London Concrete Machinery Co. Limited

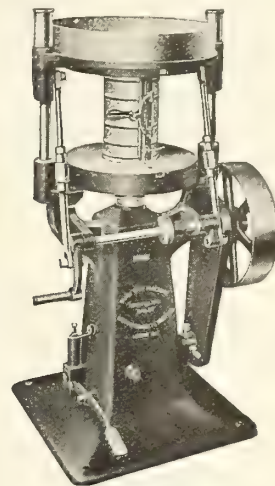
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CALGARY—622 9th Ave. West—P. D. McLaren, Manager.
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Dunn Cement Drain Tile Machine

Herringbone Metal Lath



is constructed like a miniature floor. The joists are the ribs and the flooring is the cross filament.

No one ever thinks of building a floor without joists. Every thinking man realizes that if he replaces ordinary metal lath with Herringbone Ribbed Lath, he will get superior construction.

Clarence W. Noble,

Winnipeg

General Sales Agent

117 Home Life Building, TORONTO

Montreal

The Metal Shingle & Siding Company, Manufacturers

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Filters
American Water Softener Co.

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Ontario Lime Co., Ltd.
Smyth & Ryan

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Pedlar People Limited.
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Lecky & Collis

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Consumers Gas Co.

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Sheldons Limited
Canadian Sirocco Co.

Forgings
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Hobbs Mfg. Co.
Luxfer Prism Co.
Toronto Plate Glass Imp't'g Co.

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Dull Co., Raymond W.

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Canadian Ingersoll-Rand Co.

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Escher Wyss & Co.
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Pittsburgh Valve, Foundry &
Construction Company

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Roelofson Elevator Works

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American Hoist & Derrick Co.
Beatty & Sons, M.
Browning Company
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Jenckes Machine Co.
Hopkins & Co., F. H.
Lecky & Collis
Marsh & Henthorn
Morris Hoist & Crane Co., Her-
bert.
Mussens Limited
Royce Limited
Sturtevant Co. of Can. Ltd., B. F.

Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Co.
Sheldons Limited

Hoisting Engines
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Wettlaufer Bros.

Hydrants
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company

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Linde British Refrigeration Co.

Insulating Compounds
Standard Underground Cable Co.
of Canada, Limited

Interior Finish and Doors
Batts Limited
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Rhodes Curry & Co.

Jib Cranes (all kinds)
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bert.

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Canadian Sirocco Co.
Berg Machinery Mfg. Co.

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Ontario Lime Co., Ltd.

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Boving Company of Canada
Canadian Allis-Chalmers, Ltd.
Canadian Locomotive Company
Montreal Locomotive Works
F. H. Hopkins Co.
Mussens Limited

Marble
Mississquoi Lantz Corporation

Metal Lath
Greening Wire Co., B.
Metallic Roofing Co.
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Pedlar People Limited.
Steel & Radiation Ltd

Meters, Electrical
Ferranti Electrical Mfg. Co.
Canadian Allis-Chalmers, Ltd.

Meters, Water
Hopkins & Co., F. H.
McDougall Caledonian Iron Wks
Neptune Meter Co.

Overhead Runways
Morris Crane & Hoist Co., Her-
bert.

Paints and Varnishes
Dominion Paint Works
Hopkins & Co., F. H.
Montreal Locomotive Works
Mussens Limited
Rock & Power Machinery, Ltd.
Thew Automatic Shovel Co.

(Continued on Page 14)



Ferranti Transformers

A transformer to be efficient must be economical to install, economical to operate and must have a minimum of core and copper loss. These good points will be found in Ferranti Three Phase Transformers.

Whether on the line or in the station Ferranti Transformers will give all-day high efficiency.

The design is very substantial and all parts are easily accessible.

Let us quote you prices

The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

Farmers' Advocate Building, WINNIPEG
Cor. Notre Dame & Langside,



Mr. Carl L. Falstrom of Parry Sound, just finishing a street crossing with "Abram" Wrist Motion Tools. His **Unsolicited Letter**.

CARL L. FALSTROM
GENERAL CONTRACTOR
MAKING AND REPAIRING
CONCRETE MARKS & BRICK LAYING

PARRY SOUND, ONT. Aug. 25, 1913.

*Abram cement tool co
Windsor Ont.*

Dear Sirs:

*I must say that your tools
are all you claim for them three men
with the old style tools could not do as
much nor as fine a job as one man with
your tools. I for my sake would not
use any other tools in sidewalk work or
in laying floors. Yours truly*

C. L. Falstrom.

ABRAM CEMENT TOOL CO., WINDSOR, ONT.

WESTERN

Dump Cars Elevating Graders
Dump Wagons Wheeled Scrapers

HAVE NO EQUAL

Since the Western Wheeled Scraper Company began business in 1877, it has been our policy right along to make the very best goods possible, regardless of cost. Therefore while the first cost of Western products may in some cases be more than that of other makes, yet in the end they prove the cheapest because they are rapid and economical.

The Western line of earth and stone handling machinery is always to the front where work is to be done quickly and satisfactorily.

Write for Booklet

Western Wheeled Scraper Co.

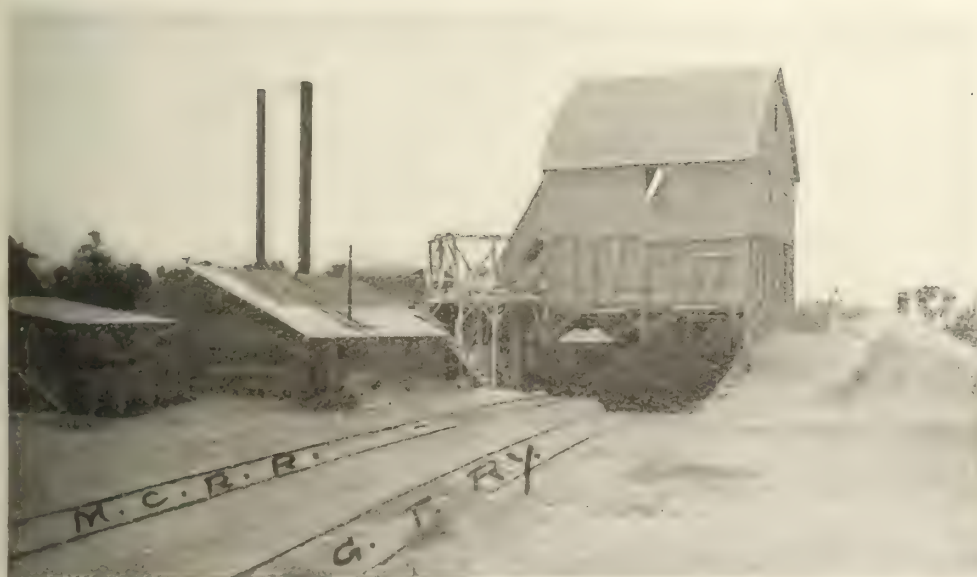
AURORA, ILLINOIS

Earth and Stone Handling Machinery

Dominion Equipment & Supply Co., Winnipeg-Calgary-
Edmonton—Agents for Manitoba, Saskatchewan & Alberta

Canadian Equipment Co., Montreal
Agents for Eastern Canada

Macadam Roads



*must be built
of a*

**Tough
Stone**

*that
will cement*

WE HAVE IT

The Hagersville Contracting Company, Limited
Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

- Paints (Bridge and Structural Iron and Pipe Coating)**
 Dominion Paint Works
 Ottawa Paint Co.
- Paving and Paving Materials**
 Asphalt & Supply Co.
 Aztec Oil Asphalt Co.
 Baker Co., R. D.
 Barber Asphalt Paving Co.
 Dominion Creosoting Company
 Ontario Asphalt Block Co.
 Paterson Mfg. Co., B.
- Perforated Metals**
 Canada Wire & Iron Goods Co.
 Greening Wire Co., B.
- Pipe (Concrete, Iron and Wood)**
 American Spiral Pipe Works
 Canadian Allis-Chalmers, Ltd.
 Canadian Pipe Co.
 Dominion Concrete Co.
 Dominion Wood Pipe Co.
 Gartshore-Thomson Pipe Co.
 Mannesmann Tube Company.
 National Concrete Mfg. Co.
 National Iron Works
 National Pipe & Foundry Co.
 Pacific Coast Pipe Co.
 Piggott & Co., Thos.
 United States Cast Iron Pipe Co.
 Vancouver Wood Pipe & Tank Company.
 Walsh Plate & Structural Works.
- Pile Driving Machinery**
 American Hoist & Derrick Co.
 Browning Company
 Canadian Ingersoll-Rand Co.
 Lecky & Collis
- Pipe Fittings and Flanges**
 Pittsburgh Valve, Foundry & Construction Company
- Plumbing Supplies**
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- Planing Mill Exhausters**
 Canadian Buffalo Forge Co.
 Sheldons Limited
 Canadian Sirocco Co.
- Plaster**
 Alabastine Hardmortar Co.
 Albert Mfg. Company
 Britnell & Company
 Ontario Lime Co., Ltd.
- Plumbing**
 Dietrich Limited
- Pneumatic Machinery**
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- Portable Saws**
 Canadian Fairbanks-Morse Co.
- Portable Track**
 Bechtels Limited
- Pumps and Pumping Machinery**
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 Boving Company of Canada
 Canadian Allis-Chalmers, Ltd.
 Canadian Buffalo Forge Co.
 Canadian Fairbanks-Morse Co.
 Canadian Ingersoll-Rand Co.
 Canadian Sirocco Co.
 Cook, A. D.
 Gray Mfg. & Machine Co.
 Hamilton Mfg. Co., Wm.
 Honig & Mock.
 Inglis & Company, John
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 Morris Machine Works.
 Smart-Turner Machine Co.
 Waterous Engine Works Co.
 Mussels Limited
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 Canadian Ingersoll-Rand Co.
- Power Engines**
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 Jenckes Machine Company
 Canadian Allis-Chalmers, Ltd.
 Waterous Engine Works
- Quarry Machinery**
 Canadian Allis-Chalmers, Ltd.
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 Lecky & Collis
 George Anderson & Co.
 Rock & Power Machinery, Ltd.
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- Railway Supplies**
 Gartshore, John J.
 Hopkins & Co., F. H.
 Lecky & Collis
 Mussels Limited
- Refrigeration Machinery**
 Equipment & Supplies, Limited.
 Linde British Refrigeration Co.
- Reinforcements, Concrete & Steel**
 Canada Steel Co., Ltd.
 Canada Wire & Iron Goods Co.
 Dominion Iron & Steel Co.
 Greening Wire Co., B.
 Pedlar People Limited.
 Steel Company of Canada
 Steel & Radiation Ltd.
 Trussed Concrete Steel Co.
 Turner, C. A. P.
- Road Asphalt**
 Barber Asphalt Paving Co.
 Asphalt & Supply Co.
- Road Machinery**
 Dore & Fils
 Lecky & Collis
 Morrison & Co., T. A.
 Mussels Limited
 Waterous Engine Works Co.
 Western Wheeled Scraper Co.
- Revolving Stone Screens**
 Greening Wire Co., B.
- Rubber Belting**
 Goodyear Tire & Rubber Co.
 Canadian Fairbanks-Morse Co.
- Roofing Material**
 Asbestos Mfg. Company
 Barber Asphalt Paving Co.
 Bird & Son
 Can. H. W. Johns-Manville Co.
 Can. Supply & Contracting Co.
 Metallic Roofing Company
 Noble, Clarence W.
 Paterson Mfg. Co.
 Pedlar People Limited.
- Safes and Vaults**
 Taylor, J. & J.
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 Ontario Lime Co., Ltd.
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 Nova Scotia Clay Works Ltd.
 Ontario Lime Co., Ltd.
 Ontario Sewer Pipe Co.
 Smyth & Ryan
 Standard Clay Products Ltd.
- Sewer Trenching**
 Lecky & Collis
- Sound Deadening**
 Cabot, Inc., Samuel
 (Continued on page 16)

What Big Contractors

Say About This Koppel Car

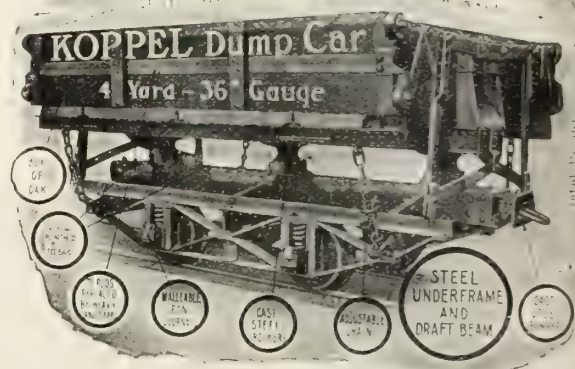
Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.



Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Good Roads Stay Good if made with—Dundas Stone

For Resistance to Wear, for Hardness, for Toughness, for Cementing value, it stands the test.

Good for Heavy and Light Traffic. Your Maintenance account after the roads are finished—reduced to a minimum. Road Superintendents, Engineers, get a copy of tests of our Stone, made by the best authorities on this Continent.

Fill in coupon at bottom of this advertisement, and same will be mailed without any obligation whatsoever to you.

Canada Crushed Stone Corp. Ltd.
DUNDAS, ONTARIO

Canada
Crushed
Stone Co.
Ltd.

Dear Sirs
Send me free a
copy of Tests of Dun-
as Stone.

Name
Address
Occupation.....

NOTE THE PERPENDICULAR POSITION OF THE Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

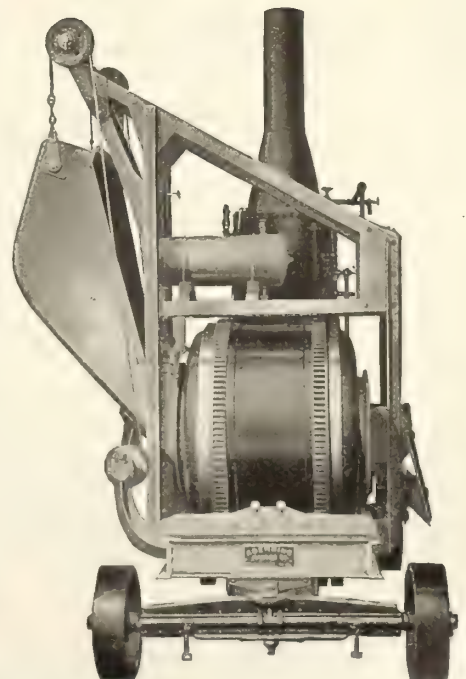
So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto Winnipeg Calgary Vancouver Montreal Ottawa



CLASSIFIED INDEX TO ADVERTISEMENTS—Continued**Shovels (Steam)**

Browning Co.
Beatty & Sons, M.
Canadian Allis-Chalmers, Ltd.

Smoke Stacks

Chicago Bridge & Iron Works
Hamilton Mfg. Co., Wm.
Manitoba Bridge & Iron Works.
Pittsburgh-DesMoines Steel Co.
Walsh Plate & Structural Works

Stains, Shingle, Cement & Brick

Cabot, Inc., Samuel

Stair Builders

McGregor & McIntyre

Steam Apparatus and Specialties

Canadian Buffalo Forge Co.
Pittsburgh Valve, Foundry and
Construction Company
Sheldons Limited
Sturtevant Co. of Can. Ltd. B. F.

Steel Doors

Gray Mfg. & Machine Co.

Steel Trucks

Gray Mfg. & Machine Co.

Steel Tubes

Mannesmann Tube Co.

Steam Turbines

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McDougall Caledonian Iron Wks.

Steel

Canada Steel Co., Ltd.
Can. Billings & Spencer
Lecky & Collis

Steel Bars

Canada Steel Co., Ltd.
Dominion Iron & Steel Co.
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Steel & Radiation, Ltd.

Steel Pipe

Gerald Lomer, Limited
Mannesmann Tube Company.

Steel Sheet Piling

Drury Company, H. A.

Stone

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Consolidated Stone Company
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Sand & Supplies
Smyth & Ryan

Stone Saws

Anderson, Geo.

Store Fronts

Zouri Drawn Metals Co.

Structural Iron and Steel

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Canada Steel Company
Chicago Bridge & Iron Works
Dominion Bridge Company
Drury Company, H. A.
Hamilton Bridge Works Co.
Mackinnon Holmes & Co.
Manitoba Bridge & Iron Works
Maritime Bridge Company
McGregor & McIntyre
Phoenix Bridge & Iron Works
Pittsburgh-DesMoines Steel Co.
Reid & Brown
Sarnia Bridge Company
Steel Company of Canada
Structural Steel Company
Standard Steel Construction Co.
Toronto Structural Steel Co.
Walsh Plate & Structural Works

Submarine Drills

Lecky & Collis

Swinging Gears

Dake Engine Company

Tanks and Stand Pipes

Chicago Bridge & Iron Works
Hamilton Mfg. Co., Wm.
Inglis, John
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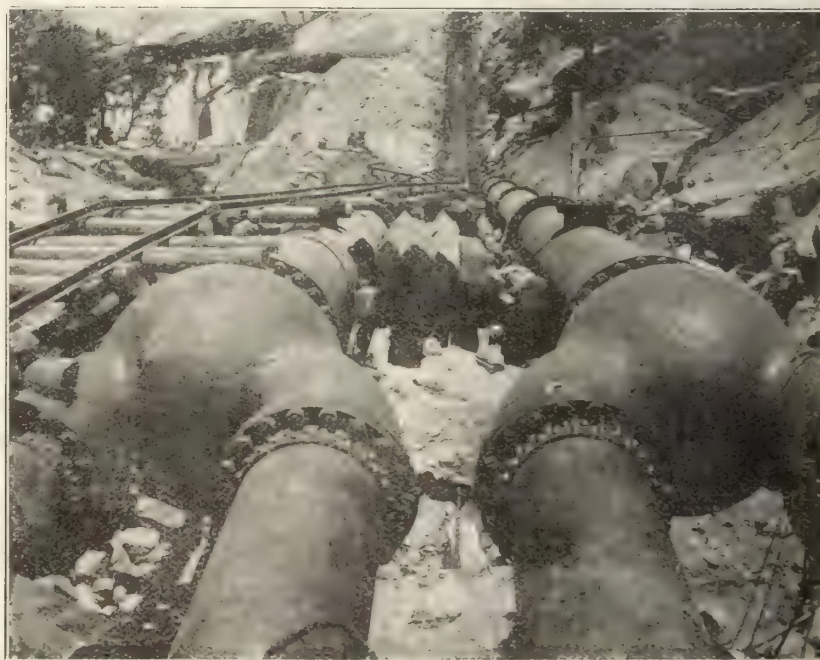
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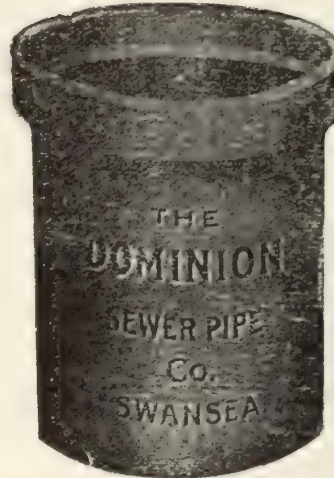
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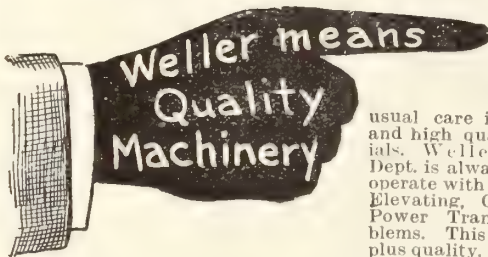
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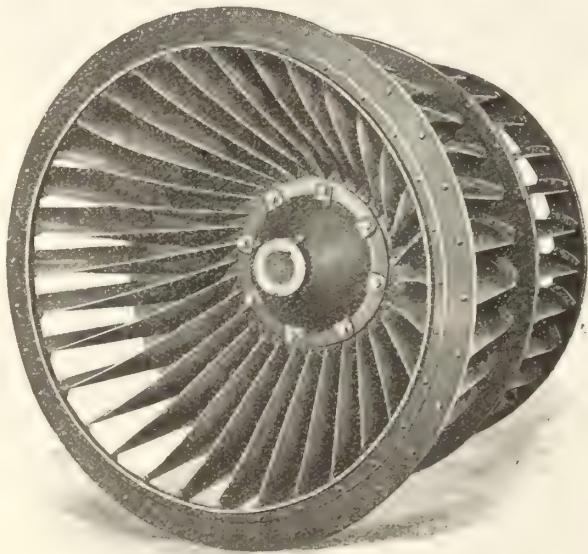
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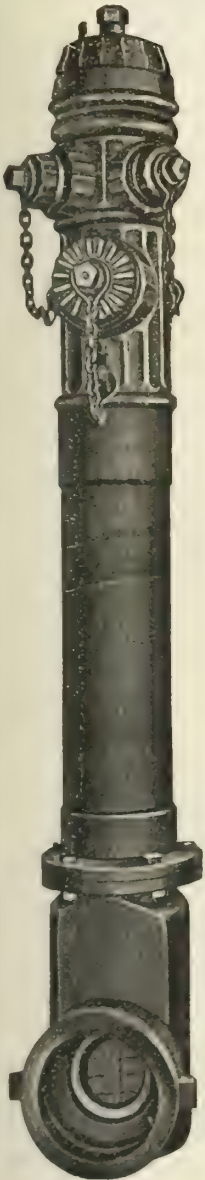
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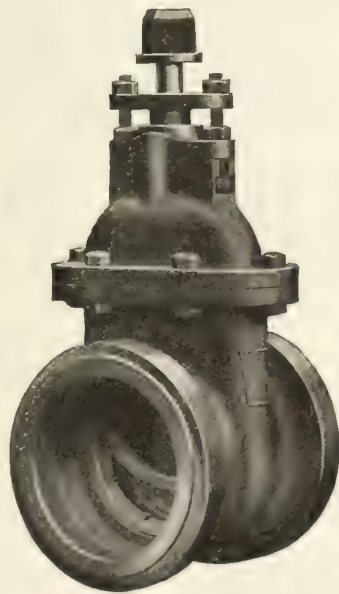
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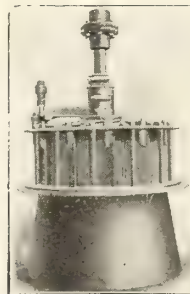
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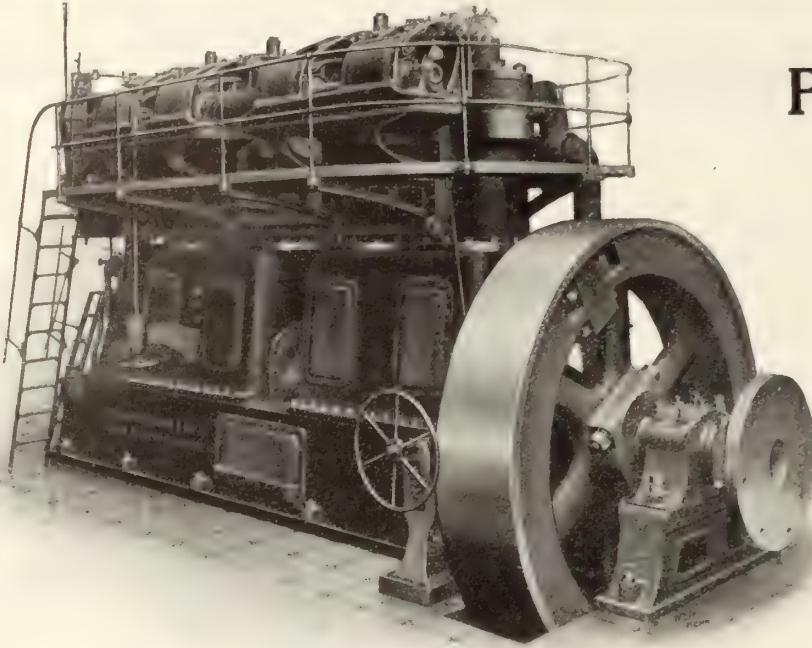
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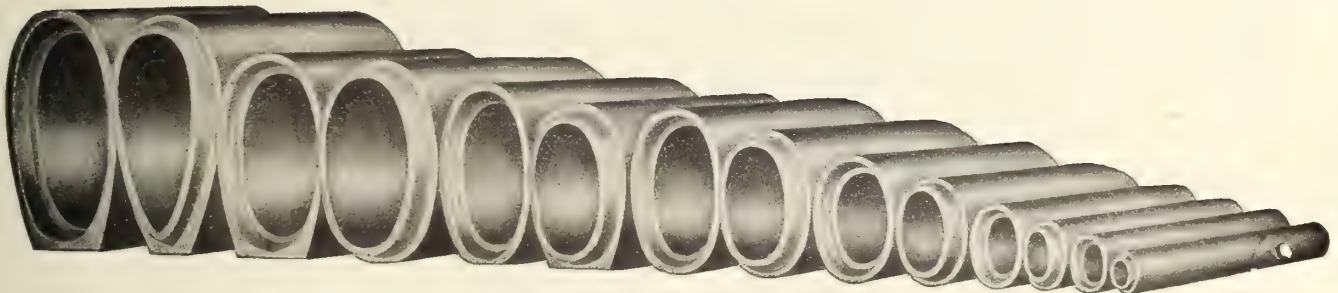
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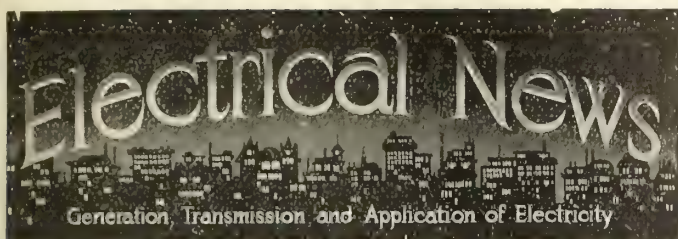
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- Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1116 pages. Illustrated. Price \$1.50.
- Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.
- Iron & Steel, by O. F. Hudson. Published in 1913 by Constable & Company, Limited, London. 174 pages. Illustrated. Price \$1.00.
- Asphalt Construction for Pavements and Highways, by Clifford Richardson. Published in 1913 by McGraw-Hill Book Company, New York. 156 pages. Illustrated. Price \$1.50.
- Concretes, Cements, Mortars, Plasters and Stucco, by Fred T. Hodgson. Published in 1906 by Frederick J. Drake & Co., Chicago. 520 pages. Price \$1.00.
- A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price \$1.00.
- The Theory of the Flexure and Strength of Rectangular Flat Plates Applied to Reinforced Concrete Floor Slabs, by Henry T. Eddy. Published in 1913 by Rogers & Company, Minneapolis. 104 pages. Illustrated. Price \$2.00.
- Specifications for Street Roadway Pavements, by S. Whinery. Published in 1913 by McGraw-Hill Book Company, New York. 116 pages. Price 75c.
- School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price \$1.00.
- Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton, Mifflin & Company. 98 pages. Illustrated. Price \$1.00.
- Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price \$1.00.
- Reinforced Concrete Construction, by George A. Hool. Published in 1912 by McGraw-Hill Book Company, New York. 254 pages. Illustrated. Price \$2.00.
- Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price \$2.00.
- A Treatise on Concrete Plain and Reinforced, by Frederick W. Taylor. Published in 1905 by John Wiley & Sons. 584 pages. Illustrated. Price \$1.50.
- Engineering as a Vocation, by Ernest McCullough. Published in 1911 by David Williams Company, New York. 200 pages. Price 50c.
- The Sanitation of a Country House, by Dr. Harvey B. Bashore. Published in 1905 by John Wiley & Sons. 102 pages. Illustrated. Price 50c.
- Reinforced Concrete, by Charles S. Hill. Published in 1906 by The Engineering News Publishing Company, New York. 498 pages. Illustrated. Price \$2.00.

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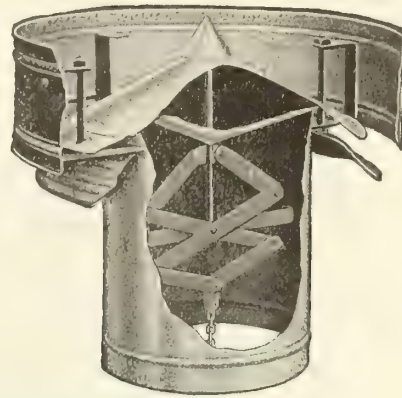
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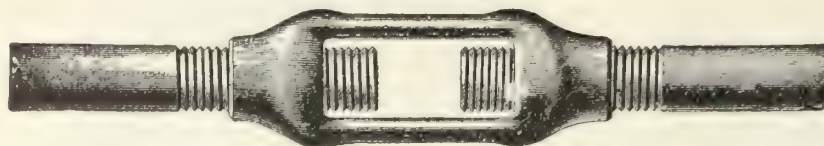
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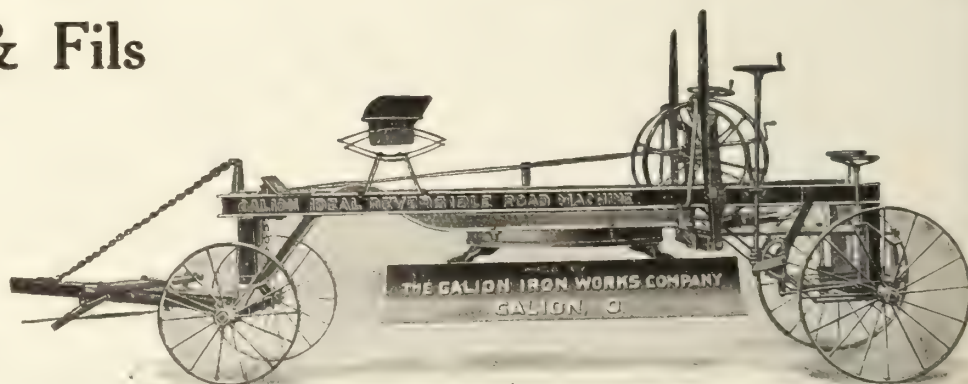
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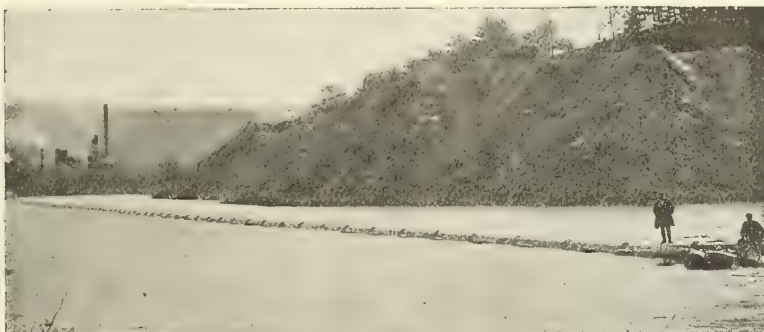
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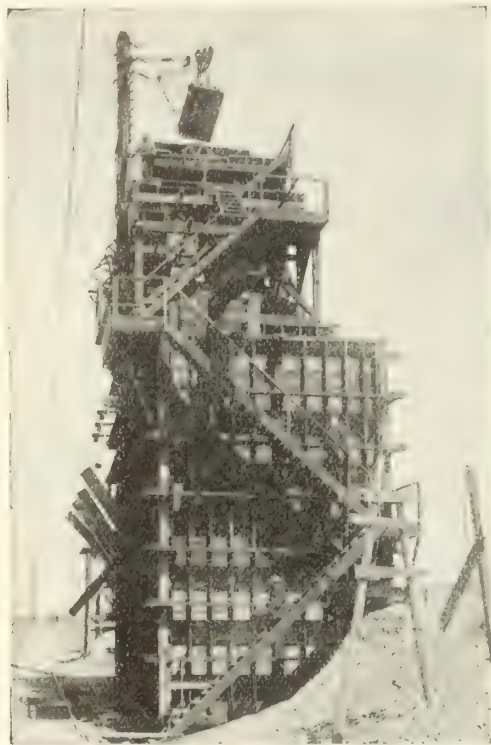
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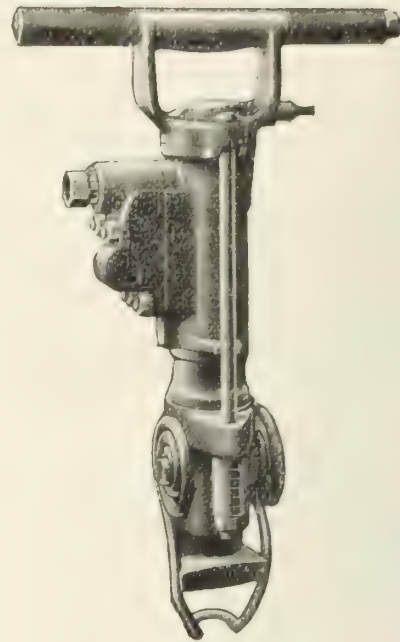
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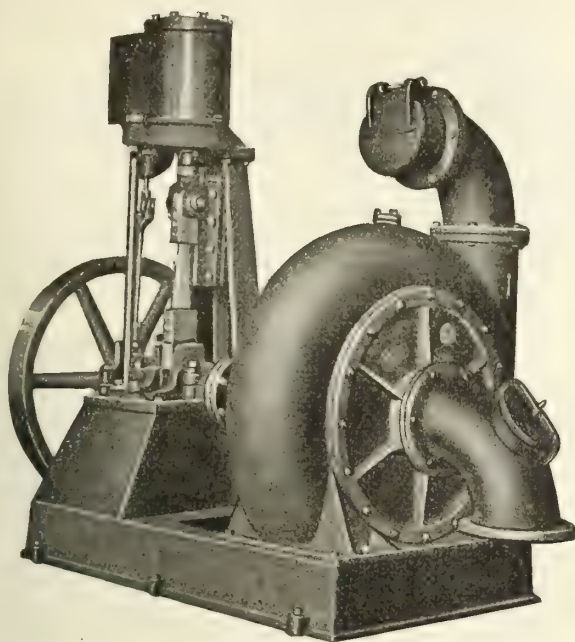
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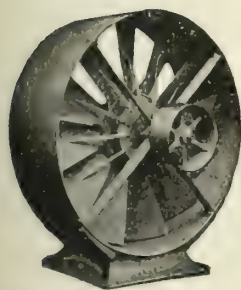
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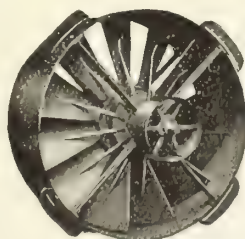


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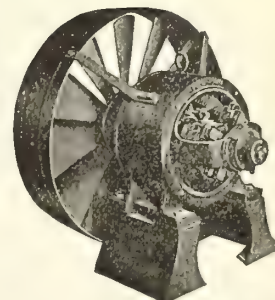
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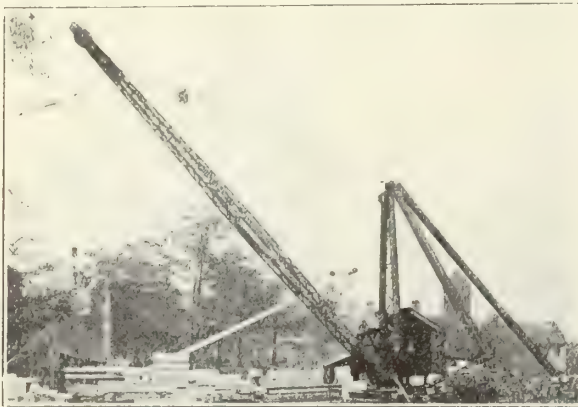


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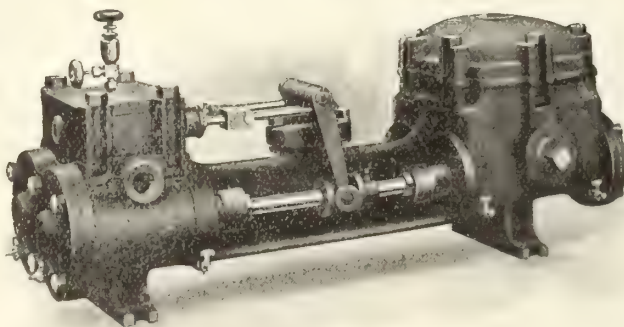
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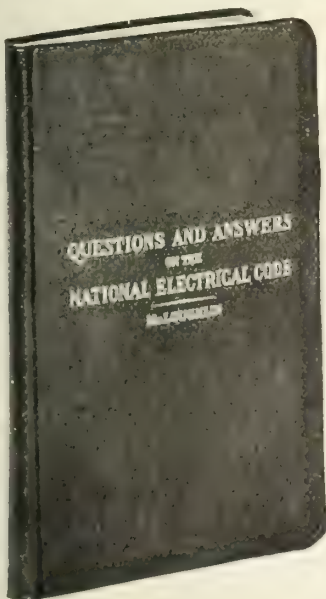
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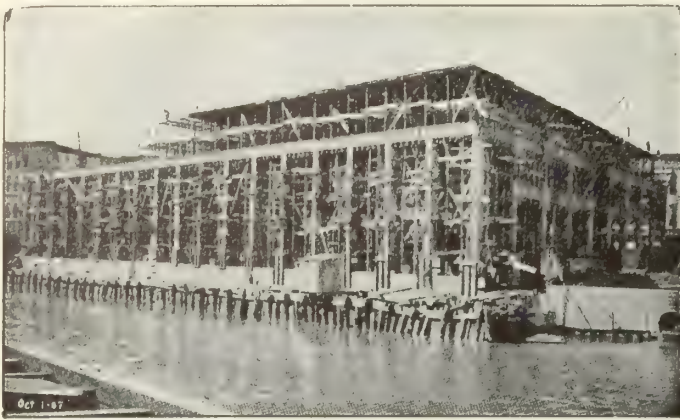
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Contract Record

ESTABLISHED 1886

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First Canadian and International Good Roads Congress

THE First Canadian and International Good Roads Congress which is to be held from May 18 to May 23 in the New Birks Building, Montreal, promises to be an event of considerable interest. It will take place under the auspices of the Canadian Highway Association and the Canadian Automobile Federation. The Exhibition has been arranged on the suggestion of several large manufacturers interested in the Good Roads movement, and matters relating to good roads legislation, the problems of construction and maintenance, the advancement of road-building, engineering and other questions of practical assistance to the movement in Canada will be dis-

cussed. It is felt that by a co-operative advocacy of a uniform system of road-building, proper methods and economical management, more practical work will be accomplished. Appropriate papers dealing with the various phases of road work will be read and discussed at the daily sessions, and prominent speakers from Canada and the United States will be present. An important feature in connection with the Congress will be the official opening of the King Edward highway, 45 miles long, connecting Montreal with the New York State roads. Invitations have been extended to government representatives, engineering societies, automobile clubs, and others interested in the Good Roads movement, and a large and representative gathering from all parts of the Dominion is anticipated. Mr. George A. McNamee, 909 New Birks Building, Montreal, is the General Secretary.

Specialization in Honors

SOME little time ago a proposal to abolish titles in Canada was defeated in the Commons at Ottawa, it being ruled that it was the royal prerogative to confer such honors. Personally, we are not of a socialistic temperament; indeed, we are rather in sympathy with one who defined the effort as "a colossal presumption." That, however, is another story. We are concerned with the question only from the viewpoint of the Contract Record and Engineering Review, and in that way we confine ourselves to commenting upon the suggestion raised by a London contemporary, namely, that in place of knighthoods, C.M.G.'s, K.C.M.G.'s, and so on, it would be a good idea to have a special Order for engineers and men of science who have rendered conspicuous service to the community. It is pointed out that titled folk, after all, are a very mixed lot and that it is impossible to find a common denominator of distinction for military men, legal experts, stock-brokers and company promoters, contractors, government and provincial officials, newspaper publishers, doctors, and so on. Undoubtedly there is a good point here. Of all classes of men who are playing an important constructive part in the country at the present time, none is better deserving of recognition than the engineer and the contractor, and it is on behalf of the interests identified with this journal that we join in the plea for some specialization in titles. A man who carries to successful completion a great engineering enterprise which will remain for generations as a monument to his ability and a boon to posterity is surely deserving of recognition equally with the man who makes millions cleverly but selfishly and afterwards distributes thousands in the cause of philanthropy. It is pointed out that the late King Edward appreciated the difficulty and solved it in a few cases by establishing the Order of Merit, and it is well contended that if King George were to follow the example and institute a new title for the engineering community, the honor would be coveted by some of the best men in the country and would impress upon the public the fact that mere makers of money are not their sole benefactors.

STRICT regulations governing the design and construction of picture houses should be enforced. The "moving picture show" has taken hold of the people and taken hold with a vengeance. Cinematograph entertainments, however, like everything else that is attractive superficially, are all right taken in moderation only. Probably the most serious

objection to them is their effect upon the eyesight. Apart from that their effect upon the general health is likely to be most harmful if the buildings are badly ventilated and not suited for the purpose. In many cases the surroundings are anything but hygienic, the

ventilation is miserably inadequate and the floors and walls are lodgments for all kinds of vile germs. The strictest surveillance over these places should be kept by our building departments and the reconstruction of old and unsuited buildings should be tabooed.

Advantages of Reinforced Concrete Caisson Construction as Exemplified in Breakwaters at Goderich, Ont.

DURING the last three seasons a very interesting work has been in progress at Goderich, Ont. This consists of the construction of breakwaters, the substructures of which are of reinforced concrete caissons filled with stone, gravel and sand and the super-structures of mass concrete. This is the first instance in which caissons of this character have been used in breakwater construction in this country. Some few years ago caissons somewhat similar in design but much smaller in size were successfully adopted by the United States War Department in the construction of breakwaters at Racine and Milwaukee.

After inspecting and studying these works, Lt.Col. Lamb, the District Engineer of the Department of

The weight of each caisson was approximately 1,711 tons in air and it was left to the discretion of the contractor whether he would build them on ways, and then launch them, or build them in a floating dry dock. He chose the latter method and constructed for the purpose a scow 114 feet long, 44 feet wide and with sides 11 ft. high. The bottom of the scow was designed with a view to avoiding buckling during course of construction. The end of the scow was fastened with hinge attachments at the lower end to permit of opening outwards and to allow egress of caissons when they were floated out of the scow. Rubber gaskets were attached and these prevented any leakage. Previous to construction the scow was pumped dry and ascertained to be free from leakage. The reinforcing iron for the floor of the caisson was laid and the reinforcing for the walls erected in frame work.

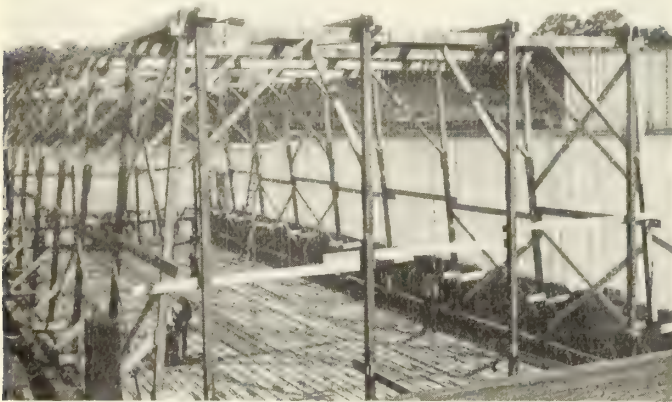
The concrete in floor was then laid, this being fed from a skip handled by a derrick placed beside the concrete plant on the dock adjoining, and sometimes from a floating plant placed on the harbour side of the scow.

The forms required for the first lift of the outer walls and the division walls were then erected and the concrete was brought up in lifts of 3 feet, the face, longitudinal, and division walls being constructed simultaneously. The forms were then raised as required.

Special care was taken in the daily testing of the sand and gravel to ensure the adoption of the best possible mixture. To this, together with the care exercised in the mixing and placing of the concrete, is attributed the success in securing practically water-tight caissons. The average mixture used consisted of $5\frac{1}{2}$ bags of cement to one cubic yard of gravel, or a proportion of 1 to 6.

When resuming concrete work on walls already built, care was taken in thoroughly cleaning the roughened surface of the old work. A wash of one to one mixture was then applied. Good bond was thus secured throughout.

When the caisson was constructed to a height of about fourteen feet eight inches, the scow had settled to a point where the top of the sides was nearly level with the surface of the water. The scow was then sunk by pumping water into the space between the sides of the caisson. The scow and concrete blocks were also lowered into the space to assist the parting of the scow from the base of the caisson and to ensure the sinking of the scow to the bottom. The end door of the scow was then opened and the caisson towed out. The completion of the caisson (floating on its own bottom) was then proceeded with. In the meantime, by lifting out the concrete blocks and closing the end door of the scow, the structure rose until the sides were above water. It was then pumped out, and within four hours and a half from the time the cais-

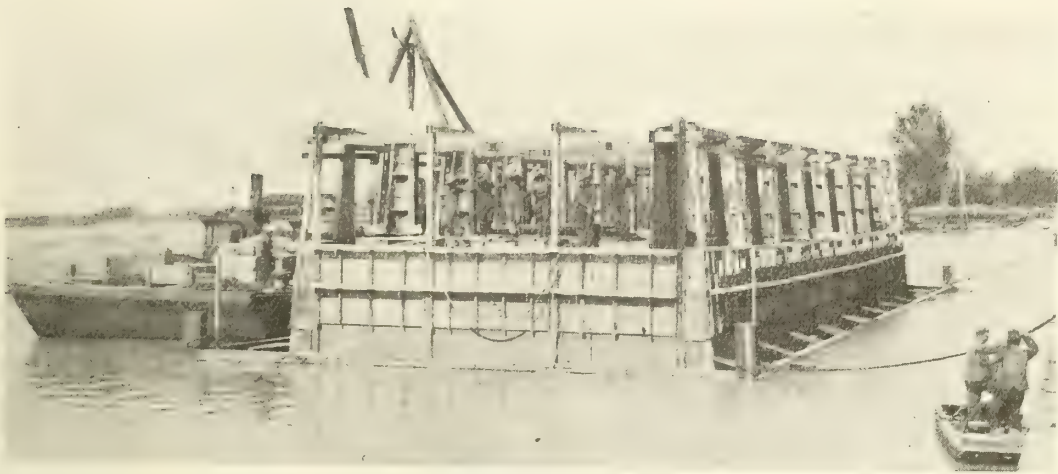


Framework and reinforced iron erected in scow ready for concrete work.

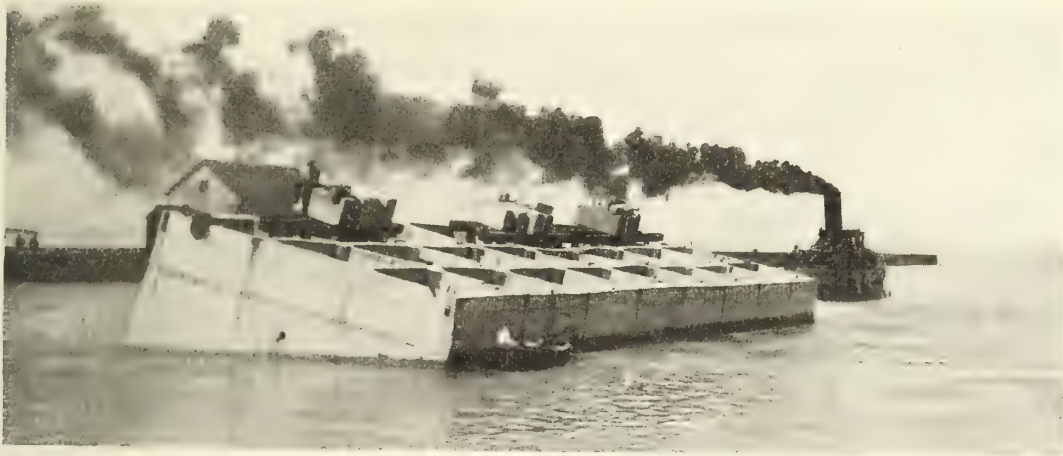
Public Works in charge of harbours and rivers in Western Ontario, supervised the design and preparation of plans and specifications for the construction of six hundred feet of breakwater to provide partial protection from the south-west storms to the entrance to piers at Goderich. The survey and detailed calculations were made by Mr. E. H. Drury and Mr. M. K. Cameron, assistants.

The plans were submitted and approved by the Department and a contract for the work was subsequently awarded to Mr. Wm. Bermingham, of Chatham, Ont. The cost of the work including inspection amounted to \$141,383.56.

The caissons are 100 feet long, 26 feet high, 35 feet wide at base and 30 feet at top. When placed they reached to 2 feet above low water level and were set in a level berth carefully prepared by dredging and swept to the required grade. The material on which the caissons were set is stiff clay and gravel, with a small percentage of sand in a few places. The settlement since the structure was completed is practically imperceptible.



Sinking scow.

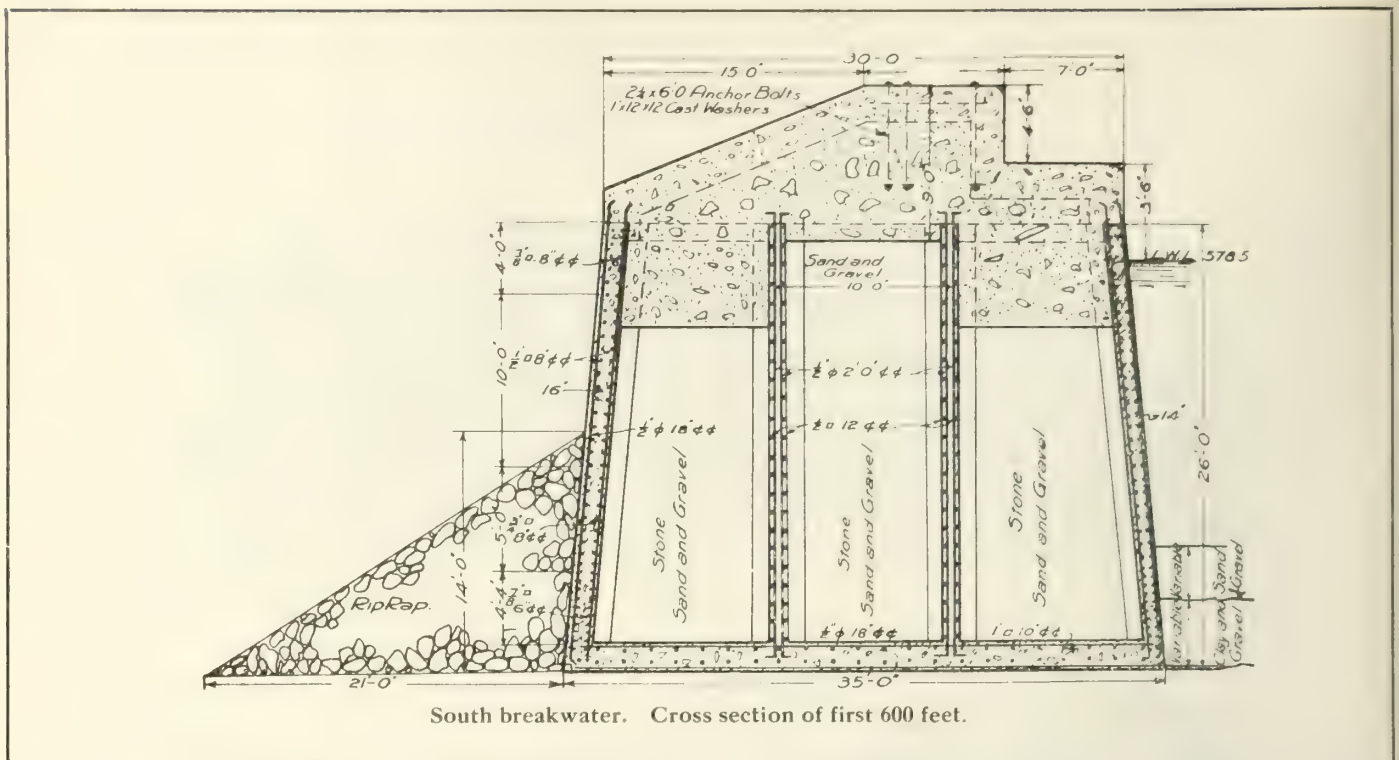


Cassion being towed out to site of breakwater.



Forms utilized in construction of superstructure and independent blocks.

REINFORCED CONCRETE CAISSON WORK AT GODERICH, ONT.



son was floated out the scow was ready for the construction of another caisson.

In the fall of 1911 three caissons were built, filled with water, and sunk in the inner harbour for the winter. The remaining three caissons were constructed between April 25 and July 4, 1912, and between June 28 and July 12, 1912, the six caissons were towed out to the site of the work and lowered into berths already prepared for them. The sweep used consisted of a reinforced concrete beam, 12 in. x 12 in. x 40 ft., and was suspended from a scow to the required depth. Owing to the greater thickness of the outer or sea-face wall of the caisson, the inner face wall was partly loaded with concrete blocks, while the caisson was being towed out into position to better equalize the draught.

To secure proper alignment, standards were fastened at the centre of each end wall and lined into position by transit on shore. The caisson was held in the required alignment by block and tackle running to dead men on either side formed of heavy concrete blocks. The process of sinking was then started by

filling the caissons with water. One 6-inch centrifugal pump was used and the time occupied in sinking and completing the filling of the caisson with water was about five and one-half hours. When thus filled, the safety of the caissons was assured. The work of filling with stone, gravel and sand was then proceeded with, after which the construction of the superstructure of mass concrete followed. In building the latter, independent monolith blocks, 10 feet wide, spaced 20 feet apart, were first constructed and the intermediate spaces were then filled in. The forms were lifted into position by derricks and carefully set to line and elevation. The filling of the form was then performed in one continuous operation.

The concrete mixture used in the superstructure was practically the same throughout, viz., $5\frac{1}{2}$ bags of cement to one cubic yard of gravel, or in the proportion of one to six, with the exception of the five feet of meagre concrete in the outer pockets of the caissons. The heavy character of the forms, and the protection which these offered to the exposed face and surface, reduced to a minimum the danger from storms once the block was completed. The construction of the



Concrete caisson partly constructed in scow and forms raised.



Six caissons sunk in extension of 1000 ft. to northwest breakwater.

super structure was started on July 31, 1912, and completed August 29 following.

On May 17, 1912, a contract was also awarded to Mr. Bermingham for the construction of an addition of one thousand feet to the existing north-west breakwater and of a design such as that already described, except that four of the caissons were 28 feet in height. To date, six hundred feet of this work is completed, with the remaining four caissons built and sunk in the inner harbour for the winter. This structure is exposed during storms to an extremely heavy wave blow, the fetch from the north-west being about 175 miles.

In making the calculations for this design, able assistance was given by Mr. H. B. R. Craig, Colonel Lamb's Senior Assistant, who also rendered valuable service in supervising the construction of the work.

It was found that the factor of safety which it was deemed wise to adopt when constructing the initial work of six hundred feet of the south-west breakwater was sufficiently large to permit of the adoption of the same design as to thickness of walls, size, spacing of reinforcement, etc., for the extension to the north-west breakwater. A large floating plant, consisting of tugs, derrick scows, concrete mixing barge, etc., is in use by the contractor. The contractor's success in

Reinforced Concrete Engineers

OWING to the widespread employment of reinforced concrete in the present day, and to the large number of firms and persons undertaking to supply designs and estimates for work in that material, it is more than ever necessary for consulting engineers, architects and prospective clients to consider the qualifications of those who specialize in the design and execution of such work.

This warning is particularly called for to-day, as architects are getting more and more into the habit of asking for competitive schemes from various firms, without much, if any, regard to the competency of those invited to submit designs. A method of procedure which thus places scientific and experienced engineers on the same level as mere business firms without technical qualifications is economically unsound for obvious reasons.

A system embodying the principle of competitive designs which are to be judged on the utterly incongruous basis of the estimated cost of the works contemplated, instead of by the intrinsic merits of the designs themselves, cannot be too strongly condemned. It puts a direct premium on cutting tactics, which must tend to diminish the adequacy of all designs submit-



Southwest breakwater nearly completed and forms for intermediate blocks under erection.

the work is due to no small extent to the untiring efforts and careful direction of the Superintendent of the work, Mr. W. L. Forrest.

In view of the assured success of this work, the adoption of the design has been decided on by the government in connection with the terminal improvements at Cape Tormentine, N.S., and also at Victoria, B.C., where the intention is to build and place concrete caissons considerably larger than those described in this article.

The principal advantages over timber crib construction appear to be as follows:—

- (1) More permanent in character.
- (2) Risk in sinking and filling practically eliminated.
- (3) Better alignment secured.
- (4) Sub-structure can be carried up above water level and thus facilitate the construction of the super-structure.

The Resident Engineer on the work is Mr. V. M. Roberts and the inspector, Mr. George Higginson.

There appears to be no doubt that this class of structure will be utilized largely in the future and it is to the credit of the Department of Public Works that it has been so successfully initiated in this country.

ted, and it should always be remembered that a design which is the most economical in first cost may not be the most economical in last cost, this being especially true in the case of structures subject to severe stresses and atmospheric conditions.

Even if a competition is limited to a small number of experienced firms there is no guarantee that the best design will be accepted, as the assessor appointed generally possesses far less experience of reinforced concrete work than the highly specialized firms competing on what is virtually a "lowest estimated cost" basis. Under such conditions it is possible for a clever but not over scrupulous designer to find loopholes in the rules and regulations specified as a standard for the competition, and while apparently working in strict accordance with the rules, to get out an exceptionally ingenious, if not ingenuous, design complying with the understood desire for low cost, but involving risks of serious nature.

To obviate the disadvantages inevitably attending the method chiefly followed to-day, it is necessary for the consulting engineer or architect in the first place to differentiate between commercial specialists who are interested as contractors, merchants or manufacturers, and specialists who work on professional lines. Those coming within the first category may appropriately

be asked to submit quotations or estimates when the time has come for the receipt of tenders, only those in the second category being invited to prepare designs, which must be judged by the criterion of efficiency and not of mere cheapness.

In the second place, the engineer or architect will be well advised in selecting one professional firm whose reputation and past record is such as to justify absolute confidence. The same process of selection is widely adopted in connection with ordinary engineer-

ing and architectural projects, where the co-operation of a structural, electrical, sanitary, ventilation, or heating specialist is necessary, and there is every reason for adopting it in cases where the essentially specialized work of designing reinforced concrete structures has to be performed. As the specialist engaged would have nothing to consider but the interests of clients, the latter would secure the important benefit of projects embodying every possible economy consistent with safety and reliability.—Ferro Concrete.

The Present Status of Sun Power

SOME interesting particulars concerning the history and present status of sun power are furnished by a London, Eng., correspondent who has discussed this latest development with the inventor, Mr. Frank Shuman, of Philadelphia. There is now in operation at Cairo, Egypt, an irrigation plant which derives its power entirely from steam generated from water by the rays of the sun. The cost of this plant was kept down to reasonable limitations by constructing the entire framework of the heat-absorbing portion of the plant in such a manner that the pieces are practically uniform and can be made quickly and cheaply by ordinary machinery from light structural iron. The manner in which mirrors are used is well illustrated on the accompanying views. These mirrors are made of ordinary window glass, specially silvered and protected, and cost only five cents a square foot. The foundation posts are of concrete and are made in place. The engine, pump and auxiliaries are the same as in any good coal-burning steam plant, except that the cylinder of the engine is larger, owing to the fact that low pressure steam is used. The heat-absorbers and steam generators are constructed entirely of concrete, steel, and glass—materials which will last many years in the tropics. The iron being easily accessible can be painted every six or eight years. The heat-absorbers are constructed to withstand a wind pressure of thirty pounds to the square foot. The Cairo plant consists of a low pressure reciprocating condensing steam engine of 100 h.p. and a reciprocating pump with all the necessary auxiliaries.

As the entire engine and pump portion of the plant is practically identical with that of ordinary coal-burning ones—except that the engine is specially invented

and constructed so as to run very economically on low pressure steam—we will confine ourselves to a description of the sun heat-absorbers and steam generators, which take the place of the boilers, furnace and stack of the coal-burning plant. The value of the whole group of inventions lies in these sun heat-absorbers, which generate the steam required to run the engine from the direct rays of the sun.

These heat-absorbers and steam generators are, in this particular plant, five in number. They are 200 feet long and 13 feet wide at the top. They consist of parabolic frames and very light structural iron set with mirrors in such a manner that these mirrors catch the sun's light and reflect it all on the two sides of the long boilers, suspended in that portion of the frame where the sun's light converges. Every five square feet of sun light received by the mirrors, is focussed thereby upon one square foot of the boilers, thus quintupling the light power on the said surface and enabling it to raise the temperature of that surface to 600 deg. Fah. As the steam pressure is not allowed to go over atmospheric pressure (equal to 212 deg. Fah.) the temperature of the boilers never goes above 212 deg. Fah., and the excess heat is transmitted into the water and produces great volumes of low pressure steam.

The boilers are flat throughout the bottom where the water is carried and along the whole top of each runs a 3½-inch diameter steam pipe, which gathers the steam along the whole line and carries it from each of the boilers into the main steam pipe through which it goes to the engine. The boilers are constructed of cast-iron in the present plant, but in future, plants will be stamped out in 12 feet long pieces from



Type of self-adjusting mirrors used in the Shuman sun plant.

one-eighth inch thick steel tubes, very quickly and cheaply.

The steam after passing through the engine and doing its work is condensed into water, and pumped again into the boilers. Thus the same water is used over and over again, and only the very little needed to compensate for accidental leakage is added. As practically no new water is used there is no danger from the boilers becoming clogged with mud or scale.

High pressure steam up to 300 lbs. per square inch can be generated by these heat-absorbers, but this is not done, mainly because at the high temperature of this steam too much heat would be lost by conduction and convection into the surrounding air, and secondly, because were high pressure steam used, the boilers would have to be very strongly constructed and cost considerably more money, and necessitate heavier frame construction to carry them than is now the case.

The five heat-absorbers carrying the boilers are set in line due north and south on rollers and gears, carried on proper foundation posts of concrete and are turned slowly from an eastern aspect in the morning to a western one in the evening, so that at all times of the day they exactly face the sun, and generate



Shuman sun power plant. Machinery equipment.

steam. To effect this exact facing of the sun throughout the day, a very ingenious adaptation of the thermostat was invented, which we have not here the time to describe in detail.

The very important element of expansion and contraction was carefully considered in the construction of these heat-absorbers, and many trials were made before all the disturbances were eliminated. The boilers are covered with a single thickness of window glass to prevent loss of heat. Generally speaking from every acre of surface covered by mirrors 250 h.p. can be obtained.

As further experience is gained, and better machinery acquired for manufacturing sun power plants, the cost as compared with a coal-burning plant will quickly go down. By availing ourselves of well-known methods of storing heat by means of boiling water, a sun power plant of any size can be constructed to run night and day and even through one or possibly two rainy days if necessary. By means of this storage in tropical countries, perfectly steady power can be given throughout the twenty-four hours. Sun power can be generated in large plants located in the desert proper on the border of cultivatable land and the power transmitted by electricity over large areas.

The construction of the Egyptian sun power plant is particularly simple, and thoroughly practical in

every way. Any ordinary engineer can run it. Owing to the fact that ordinary materials are used in its construction, repairs can be easily made and everything is above ground and accessible.

A wash, consisting of a dilute solution of hydrochloric acid, one part of commercial 30 per cent. acid to five parts of water, has been found effective in cleaning the stains, due to weather, and other causes, from the concrete surfaces of lock walls. A test was recently conducted on the center wall lamp standards of the middle lock at Gatun. The surface of the concrete was brushed over with the solution, and afterwards was rinsed with clear water. The application and subsequent rinsing freed the concrete of all discoloration. The process has proved satisfactory, but will be kept under observation before further work is done.

Some concrete fences recently erected in St. Louis are of a combination shop and field built type. The posts, 6 x 8 inches above ground and 12 inches square below ground, were made in a shop. They were from 9 to 10 ft. high, the portion under ground being 3 ft. long. The posts were then erected about 6 to 9 ft. centers, and five 1/2 in. diam. horizontal bars placed in holes in the posts at a uniform vertical spacing, to serve as main panel reinforcing. These bars reach only from centre of posts, so as to provide, in a measure for expansion and contraction of the concrete. Vertical rods 3/16 in. in diam., are tied to the horizontal bars at intervals of about a foot. Solid concrete panels 4 in. thick were then cast between the posts. The panels were scrubbed with wire brushes as soon as forms could be removed, while the posts have a troweled finish.

Engineers are asked to be chary of taking positions that require the accompaniment of cash. We hear that a raid was made recently upon a Cleveland firm who had been advertising for engineers and had induced them to part with some \$30,000. The attraction was a permanent position with the concern, but the great engineering enterprises which it professed to have on hand never materialized. It is well contended that reputable firms with large contracts want brains and not money in dribbles of a few thousands. Here in Canada, fortunately, our experiences of deception in the engineering field are few, but we are not immune from the possibility of being imposed upon and a note of warning may be sounded in time.

Engineers employed in the construction of new wharfs at Terminal Island, San Pedro, Cal., have been experimenting, with considerable success, with vitrified clay pipe as a protection to piles, from the destructive parasites. It has been the custom heretofore to creosote the wood piles to protect them from the ravages of the teredo and linoria. This process is expensive, and by the use of vitrified clay pipe it seems that the problem of securing a less costly substitute has been solved. The wooden piles are covered with 14 or 16 inch clay pipe, the pipe being placed over the piles as soon as they are driven, and allowed to sink with their own weight into the mud at the bottom, and the space between the pile and the pipe filled with sand, which is particularly disliked by both the parasites mentioned.

Efficiency of the Engineer-Manager Plan of Municipal Government

THE matter of an improved form of administration for Canadian towns and cities has engaged our mind for many moons and our ideas have been translated into several editorial articles published in these columns. Whether effectively or ineffectively—we hesitate to express an opinion—our articles have provoked considerable discussion, in witness whereof we refer to many valuable contributions published in recent numbers.

In our issue of January 21 we referred editorially to the City-Manager plan of government which had gone into effect at Dayton, Ohio, and we suggested that a discussion of the scheme would be timely. With a view to focussing the attention of our readers upon this point in the hope of bringing out the possibility of other forms of administration it may be well to give a few leaves from the experience of the city of Abilene, Kan., where a population of five thousand is governed by the Engineer-Manager form of government. Our information is abstracted by our Chicago contemporary, Engineering and Contracting, from a paper by Mr. Kenyon Riddle, who holds the position of Engineer-Manager at Abilene.

The success of any good business is possible if it is controlled properly. Imagine some piece of construction work being carried on by a body of men and each man having equal authority, or a railroad under such conditions. Nevertheless, this is the encumbrance which a great deal of city work struggles against. However, work done under standard specifications is saved by the clause, "All instructions shall be given to the contractor through the engineer." This clause guards against the unlimited confusion that would result if no one person were made the head.

In maintenance work and the general business of the city, though, is where confusion arises from too many men giving directions to the city's employees and from giving individual orders. Every important move of the commission should be acted upon by the body as a whole, then delivered to one man for disposal or distribution to the proper heads or departments. This removes individual action by any one member of the board, and it also cancels any feelings of jealousy among the board members. It makes the commission as a body responsible for the act and the one man is made to account for putting this act into service. The manager, being a salaried man with no definite term of office, naturally would strive to give his best service, since the length of his term depends upon his capability.

Preferably the manager should be without extensive interests in the town or city which he serves. This makes it more possible for him to give impartial views in matters concerning employment of labor and purchasing of material. His preparation should consist in a thorough education along the lines of general engineering rather than a knowledge of a few special branches. This will make it possible for him to advise and check up, in a general way, every act of the engineering department. He should also have an understanding of values and be able to estimate all classes of construction and maintenance work, be

economical and able to establish systems of record-keeping and cost-keeping, and have a general conception of business methods and finances. In addition to this he should have an understanding of the city's sanitary and social conditions, which exert an important bearing upon public welfare. Inefficiency here causes every imaginable trouble. Here is involved the street cleaning and disposal, water system and supply, sanitary sewer system, drainage system, the working and living quarters of every class of people, the transportation facilities, and numerous other items.

A general knowledge of all of the above particulars is not too much to expect of a city manager. However, since men have not prepared themselves for this particular situation it may be well to try the new system of control in smaller towns, for in these places some of the qualifications of manager can be stricken out entirely and others are of much less importance. On the other hand, in the larger cities the different departments are more complete in themselves and would require less direct supervision and advice from the manager.

Since these requirements have been enumerated it is not at all difficult to see that the great majority of the city's affairs are of an engineering nature and should be managed by an engineer.

Adaptation to Towns and Small Cities

Since the engineer-manager plan is especially applicable to the average sized towns of 3,000 to 25,000 or 50,000, and since its success is more probable in these places, let us confine ourselves to this particular application.

In order to demonstrate the importance of the adoption of this more simplified form some of the defects of the older and more complex forms might be brought out. These innumerable defects have been the cause of an awakening on the part of the people who wish better administration.

People have commenced to see that public affairs as a rule have not been handled in a business way, but rather along lines of politics; and when business becomes mixed with politics then efficiency is replaced by inefficiency. Instead of each member of the governing board exerting his efforts along the lines he believes to be best and in a manner desired by the people, he is very often misled by reason of political views. Appointments are very often made because of favoritism or by reason of political debt. Also due to politics, every citizen is not treated on an equal basis. Improvements are centered around certain localities, and are not distributed in an impartial way. Everyone is aware of the fact that money is wasted in nearly all public business. Some of the dissipation of the tax money is often due to graft, etc., but most of it is the result of poor management, lack of harmony among the board members and a lack of knowledge along particular lines, especially in the engineering department of smaller towns and the purchasing department of nearly all municipalities. No doubt the larger cities lose money in their engineering departments, due to lack of management, and the department is possibly hampered by politics. Nevertheless they do not lack

in principles of engineering practice as do the smaller towns.

Therefore, in consideration of the small town the main object in order to secure efficiency where it is most lacking is to devise some scheme whereby the town can feel justified in having the services of an engineer at all times, and this remedy lies in the engineering-manager plan. It will be shown later on how the creation of this office is possible for any town and how it can be made remunerative.

We might account for wastes due to a complex system of management. The particular duties of different officials and departments are not well defined, thereby causing confusion and resulting in loss of time, which is loss of money.

Wastes due to lack of harmony are quite common. This lack of harmony is usually traced back to differences of politics or possibly jealousy among the different members. Without harmony there is no unity and without unity all advancement is retarded.

Source of Greatest Waste

But the principal dissipation of funds comes from lack of knowledge, and this particular shortage is most often conspicuous in the engineering department, and since the great majority of the city's business is of an engineering nature this makes up the greatest waste. This particular argument best fits a small town, since these are the towns which are believed to be too small to feel the necessity of employing an engineer the year around. These are the places where a lack of knowledge makes up the principal reason for receiving about three-fourths value on each dollar spent in taxes. The permanent improvements and systems in such places are the nucleus for possible larger systems. Therefore they should be carefully planned so as to meet future conditions. They should be accurately recorded also.

If a town or city had some means of figuring the money wasted in prospecting for lost underground systems, in the improvements buried and never found, in systems that are built with no idea of future growth and that have to be abandoned years before they are worn out, in the grading and re-grading of streets, in sinking hundreds of dollars into permanent culverts and waterways built with no idea of future drainage and that have to be broken out when pavement is laid, it would be no difficult matter to prove the economy of city planning and of proper management.

How could anything else be expected from a council or commission composed of bankers, lawyers, farmers and men who have devoted their efforts to their professions and who are in active business and cannot neglect it to make a study of engineering so as to carry out some drainage proposition or such for the city, their salaries being anything from \$1 to \$25 per month?

As soon as a town reaches a size which justifies permanent improvements, from that time on systematic methods should be carried out, and a capable man who is paid a fair salary and feels permanency in his position is more apt to be able to do these things than a council or commission. It very seldom is the case that the successor will follow plans laid down by his predecessor. On the contrary, not only will he refuse to follow his predecessor's plans, but he will exert his efforts in tearing them down.

With an engineer-manager it is possible to get the very best and most active business men to serve on the commission, since their duties are reduced to a few hours a week. Furthermore, it is generally ad-

mitted that the holding of a political job is not a successful means of increasing one's business, but under the new plan all complaints and grievances may be put to the manager, such as come up every day of a lack of water pressure, sluggish sewers, poor drainage, etc.; and since he is not elected by the people, but appointed by the commissioners, he may be free to act as one whose best judgment is not overpowered by some political fear. By hiring a manager the hindrances of politics are eliminated and professionalism is substituted.

Can anyone argue that this will not bring about efficiency? The average person cannot realize that paying what now seems like an exorbitant salary for expert men is economy. The principal reason is that one can see the expense of salaries, but can not discern the huge waste due to poor and inadequate management. This waste invariably exceeds the expenditures that might be made for men capable of handling public affairs.

Now, the way to eliminate these objectionable features of the old style of administration is to adopt commission form of government as the executive board and as representatives of the people, and for them to select, by purely business methods, an expert through whom they can look for professional advice. As a result of this professional advice many blunders in the town's affairs can be overcome.

Deplorable Condition Under Present System

Every person here who has had any experience with the different systems of a city well knows the deplorable conditions which some of these are in. The distribution of the water comprises a length of misfit, complicated pipes and valves, with absolutely no records of the underground system—the result of having untrained, inexperienced men who wish to experiment along the lines of engineering, all at the expense of the city. Due to the fact that the town had no engineer, they thought it would be economy to plan and supervise their own systems and extensions. During the time that the town is small and when these errors are being made is the very time to put into practice every method of city planning, since this is the foundation of a possible larger system. And, by all means, permanent records should be kept of all underground work.

It is needless to say that the sewer systems suffer the same inexcusable poor treatment. These mistakes all bring about complicated and unnecessary expense to the city.

Also think of the money wasted in drainage systems. This is one feature on which the incompetent street commissioner of a small town professes profound knowledge. Costly and permanent waterways, etc., are built to care for drainage, with absolutely no idea of drainage, of adequate capacity, of the future outcome or development of the scheme. In a few years, the street is paved and it then becomes necessary to tear out hundreds of dollars' worth of these permanent improvements. The only means of overcoming these items of waste is for the city to proceed along lines which will insure expertness. If they were to employ an outside engineer for these less important things doubtless it would be too expensive, but the proper procedure is to devise some method whereby the town will have an engineer at their service at all times. Salvation lies in the adoption of the engineer-manager plan.

Now, to make this newly created office remunera-

five. The employment of an engineer as manager no doubt will be considered too expensive, especially for a small town. The thoroughness of record keeping which it is possible to maintain would more than obviate this objection. But there are several ways in which an income to the city's general fund can be realized by the newly created office: No matter how small the town, all sewer work, plumbing, wiring, water mains and services, meters, etc., should be inspected, and the small cost for doing this should be charged to the property owner. Then there will be the ordinary expenses of surveying lot lines, giving grades for buildings and sidewalks; this would be charged to the property owner and turned into the general fund. Also, there will be the usual engineering for sewer and water extensions, curbs and pavements. And finally, if the manager has charge of the street work, the street commissioner's salary may be added. The aggregate of these different amounts, if the town were doing its share of improvement work, would average from \$100 to \$150 per month, a sufficient amount to employ a competent engineer, without extra draft on the city's funds.

Economy at Abilene

To prove that this is not all theory let us consider the savings already made in Abilene, Kansas, a town of 5,000 population, which town has been controlled by commission form of government and an engineer-manager for the past eight months. During this time the following improvements have been made:

Street improvements	\$80,000
Ornamental street light system, consisting of five-light and single-light concrete standards, cost of instalment, city's share	1,200
Light company's share	6,800
(The city has a contract with the light company to pay \$3,000 a year for three hundred 40-watt lamps; about one-half of these are burned every night in the week, and the balance are burned about one-half the time.)	
Waterworks improvements, consisting of general overhauling and new pump at plant and booster pump	5,275
Water main extensions	2,910
Sewer extensions	2,136

Making a total of\$98,321

Later on there will be shown a few examples of savings as a result of proper management. Credit for these savings is given to the methods employed, such as: Preliminary estimates, which save the city from overcharges; plans and specifications, which insure better workmanship and speed; system; supervision and inspection, and a final measurement and estimate, which insure the city of fair settlement.

A summary of the several small sewer and water extensions exhibits the following marked differences. This takes into account work done by the old administration and that done by the commission body with a superintendent or manager. Somewhat different methods have been employed in the recent work. The city has purchased all of the material and let the labor to the lowest responsible bidder. All other conditions are practically the same. That is, cost of labor and material and all other features, such as depth of trenches, quality of soil, etc., are figured the same. The comparison is based on trenches averaging 8 ft. in depth, number one 6-inch vitrified sewer pipe, flush-tanks and manholes built under the same identical circumstances.

Past methods show the following:

Excavating and refilling trenches averaging 8 ft. in depth	40.8 cts. ft.
Furnishing and laying 6-in. vitrified sewer pipe	15.5 cts. ft.
Furnishing material and building flushtanks	\$66.00 each
Furnishing material and building manholes	\$40.80 each

New methods:

Excavating and refilling trenches averaging 8 ft. in depth	25 cts. ft.
Laying 6-in. vitrified pipe	5 cts. ft.
Furnishing on works 6-in. vitrified pipe	10 cts. ft.
	15 cts. ft.
Labor on flushtanks	\$10.00
Material in flushtanks	41.80
	\$51.80 each
Labor on manholes	\$ 8.00
Material in manholes	15.00
	\$23.00 each

The saving is—in consideration of the amount done this year:

	Difference each item
4,721 lin. ft. of excavation and refilling	\$ 745.92
4,721 lin. ft. of furnishing and laying	212.44
3 flushtanks	42.60
4 manholes	71.20

Total amount saved\$1,072.16
on this one very small item of the city's business during the eight months of city management.

To save enumerating the total savings in the waterworks department I have figured that the difference between the unit costs under the old and new systems represents 8 cents per lineal foot and for the 5,010.0 ft. laid this year the saving would be \$400.80.

The cost of cleaning the pavement and disposing was cut from an average of 40 cents per 1,000 sq. yds. to 36.2 cents per 1,000 sq. yds. Therefore on the total area of 2,215,797 sq. yds. covered in order to keep 92,000 sq. yds. clean for six months there was a saving of \$842.00.

It would be too monotonous if I were to itemize every saving that has been accomplished by the more simplified form. However, in every department there has been a saving. The saving on the street cleaning was doubtless due to system. At present there is a report turned in by the street commissioner, showing the streets cleaned and the cost. From this report the number of sq. yds. is figured and the cost per 1,000 obtained. From this data different methods of cleaning have been tried until the most satisfactory method is obtained.

The dragging of dirt roads used to be considered too expensive and was therefore omitted. No one had any idea how many miles of dirt streets the town had which could be considered as arteries of traffic nor how much a mile the dragging should cost. In order to prove that all of the more important streets could be dragged at a nominal cost the streets were gone over and two districts were laid out. For each of these districts a logsheet was made, showing the streets to be covered, the number of times to cover each of them and the number of miles travelled. One district has 16½ miles to cover and the other contains 19 miles; when the streets need dragging teams are employed and each of the two outfits is paid \$6 for following out the course as listed on his log. During the past eight months—of course some of these months were quite dry—the dragging has cost \$51.

Now, besides the \$2,315 which has been saved, as itemized here, the city has a complete set of records of all underground work and of every survey made.

In order that all important work shall be authorized by the commissioners as a body, with a clear understanding on their part, a report of the coming week's work is made up, with a preliminary estimate of the cost and an account of the benefits derived. This is presented by the manager at the meeting of the board and after the work is discussed the commissioners order that which they deem necessary. The manager then takes charge and at the next meeting of the board

he reports on its progress; or if it is completed he submits the final estimate. With this procedure the commissioners are thoroughly acquainted with all of the city's affairs.

With all of the principles which have been discussed here and with the conclusive evidence of efficiency which has been cited as attained by the business-like methods which are possible in the engineer-manager plan there seems to be absolutely no question that it is the ideal form of public control, particularly for municipalities, and probably most applicable to the smaller towns while in its experimental state.

Proposed Aqueduct for Additional Water Supply of the City of Winnipeg

FROM time to time various details have been given in connection with the new water supply for the city of Winnipeg. Water is to be drawn from Shoal Lake and conducted to the city through an aqueduct more than ninety-five miles long. The design of this aqueduct is featured by Engineering and Contracting in an abstract from a report of the Board of Engineers, Messrs. Rudolph Hering, Frederick Stearns and Jas. H. Fuertes.

The new supply will be drawn from Shoal Lake, one of the lakes in the same group as the Lake of the Woods, and will be conducted to the city through an aqueduct of total length of 95.35 miles. The inlet to the aqueduct will be near the west end of Indian Bay, an arm of Shoal Lake. Leaving the lake the water will pass through a concrete aqueduct 84.75 miles in length, laid with a continuous down grade to a point about a mile east of Transcona, a suburb of Winnipeg, thence through a 5-ft. steel pipe line to the Red River, thence under the river through a 5-ft. cast iron pipe in tunnel, and thence through a 4-ft. cast iron pipe laid in the city streets, to the reservoirs at McPhillips Street. The concrete portion of the aqueduct will be given a capacity of 85,000,000 imp. gals. per day and the pipe line portion, 25,000,000 gals. per day. The construction of a 250,000,000-gal. reservoir at a point on the aqueduct about a mile east of Transcona is recommended, though not for immediate construction, and it is further recommended that a main pumping station be then established to force water to the city through the 5-ft. steel pipe. This reservoir and pumping station should be completed and ready for use before the demands for water have reached the capacity of the pipe line portion of the aqueduct.

The population of the Greater Winnipeg Water District is about 225,000, about 200,000 being in the city of Winnipeg. This population is twice that of seven years ago and five times that of 15 years ago. The average per capita consumption of water increased from 32 imp. gals. in 1902 to 47 gals. in 1912. The increase per capita is, of course, likely to continue with the increase in facilities for using water.

It is believed that 85 gals. per inhabitant is a proper quantity to adopt for estimating the future needs of the district as an average for the year, but in some months the rate will average as high as 100 gals. per inhabitant. Therefore an aqueduct to provide for a considerable time in the future should be designed with a capacity of 100 gals. per inhabitant, and even with this provision a large reservoir should be built

near the city, in the future, to provide for a still higher rate of water consumption during short periods.

The consumption of water at the present time is somewhat restricted by the limited capacity of the sources of supply and will undoubtedly increase to a considerable extent when a new supply with a better water is furnished. For the next ten years, however, the consumption is likely to be less than 85 gals. per inhabitant.

The best conduit for conveying water for the greater part of the way from Shoal Lake to Winnipeg is a concrete aqueduct laid with a continuous down grade and as such a structure can be built of large capacity for a moderate additional cost, the engineers have designed this structure to carry 85,000,000 gals. in 24 hours, sufficient, on the basis assumed, for a supply throughout the year for 850,000 inhabitants. While this is a large provision for future years, it should be borne in mind that the additional cost of making such a structure of liberal size is comparatively small while the cost of duplicating such an aqueduct would be large.

The capacity of 85,000,000 gals. daily was adopted after giving due consideration to the many demands for money for public works in a growing city like Winnipeg; otherwise a larger aqueduct, say one having a capacity of 100,000,000 gals. in 24 hours would have been recommended.

From the point near Transcona where the concrete aqueduct ends, to the existing McPhillips Street reservoirs, a pipe is recommended; and a single pipe line of the sizes which now seem desirable will convey by gravity 25,000,000 gals. of water in 24 hours, or nearly three times the quantity of water now used. When necessary, the flow through this pipe can be increased by pumping, or a second pipe can be laid.

Assuming a continuous growth for the Greater Winnipeg Water District, based upon the past growth of the district and the rate at which other somewhat similarly situated cities have grown, the 85,000,000 gal. aqueduct would have sufficient capacity for supplying the district until 1944. Assuming further the introduction of water from Shoal Lake at the earliest practicable date, the aqueduct would supply the requirements of the district for about 25 years after its completion, and the 25,000,000-gal. pipe line would supply by gravity the quantity of water required for two or three years; but, as already stated, the capacity of the pipe line can be increased by pumping.

The Aqueduct

Intake.—The intake of the aqueduct is to be located at a corner of the bay where conditions are favorable in that the shore for a long distance is rocky, and the depth of water 50 feet from the shore is 10 ft. and 170 ft. from shore it is 15 ft.

It is proposed to build the gate and screen chamber on the shore and to protect the intake from material which may drift along the shore during winds, by building piers extending at least 150 ft. into the lake on each side of the intake, or by laying a large submerged conduit to bring the water from a point at

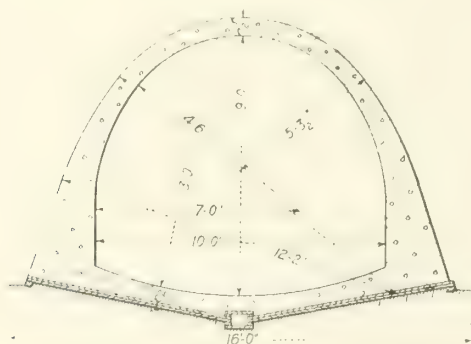


Fig. 1—Cross section of 9 x 10 ft. portion of proposed aqueduct for additional water supply of Winnipeg, Man.

Area of Section.....	73.6 sq. ft.
Perimeter.....	31.6 ft.
Hydraulic radius.....	2.33 ft.
Coefficient adapted.....	132.8
Concrete per lineal foot.....	1,156 cu. yds.

least 150 ft. from the shore. The conduit is preferable, if it can be built for nearly the same cost as the piers. The bottom of the aqueduct at the bay is 11 ft. below high water.

The gate and screen chamber should be designed with liberal areas for sluice gate openings and for screens, so as to cause as little fall of the water from the bay to the aqueduct as practicable. There should be at least two sluice gates not less than 5 ft. wide and 6 ft. high, and the screens should have a total length of not less than 50 ft. and a height extending from the bottom of the aqueduct to the surface of the water.

Aqueduct Designs.—In order to take water from Indian Bay by gravity, the aqueduct for the first nine miles has to pass through land that is higher than Indian Bay, thus necessitating a deep summit cut. After passing this nine miles, a line can be selected which will be down grade all the way to Transcona, but the gradient obtained for an aqueduct varies from place to place, and consequently the size of the aqueduct required to convey a given quantity of water also varies.

The engineers, therefore, prepared a series of designs of horseshoe-shaped aqueducts ranging from the large one, 9 ft. high and 10 ft. wide, used at the summit cut where there is a low gradient, here shown in Fig. 1, to one 5 ft. high and 5 ft. wide, used where the gradient is highest. Aqueducts of this kind are expected to flow partly full as a rule and never to have any considerable pressure of water against the top of the arch.

For the first 26,000 ft. of the concrete aqueduct, near Transcona, it is desirable to use a section which can stand internal pressure, as it will be necessary at some time in the future to build a large reservoir at the end of the concrete aqueduct, in which the high water level may be 18 or 20 ft. above the surface of

the ground and the aqueduct will be, at least in part, below the surface of the ground. This portion of the aqueduct has been designed of circular form, 8 ft. in diameter and provided with steel reinforcement. This pressure aqueduct will be equally valuable before the reservoir is built, as it will provide additional head at the end of the steel pipe to force the water through the pipe to the McPhillips Street reservoirs.

At the crossing of the Brokenhead River and the lowland each side of it, for a total distance of 13,000 ft., it has also been found desirable to adopt the circular form of aqueduct reinforced with steel so that this portion will withstand the pressure resulting from building it 10 ft. or more below the regular grade line.

As the aqueduct, with the exception of the reinforced portions above mentioned and some other short lengths at river crossings, is not expected to stand any considerable upward pressure on the arch, measures must be taken to prevent the opening of the sluice gates at Indian Bay to a height which will permit a quantity of water to enter the aqueduct much, if any, in excess of the rate of 25,000,000 gals. daily, which is the limit of the capacity of the pipe line leading from Transcona to the city reservoirs, and as a further safeguard waste weirs should be provided at several places where the aqueduct crosses streams to permit the water to overflow into such streams if it should rise above the safe elevation.

In order that the aqueduct may be both watertight, strong and permanent, it is recommended that it be built of first-class concrete mixed in the proportion of one part of Portland cement to two parts of sand and four parts of screened gravel. To prevent transverse cracks in the aqueduct, it should be built in sections not more than 20 ft. in length, and where one section joins another a steel bar about 3 inches by 1/4-in. should be inserted to act as a water stop and prevent leakage at these joints, or some other suitable water stop should be provided.

The aqueduct cross-section shown in Fig. 1 has a central wooden box drain and a platform composed of two thicknesses of 1-in. boards, the upper one being fluted on the under side to furnish channels in which the water may flow from the side of the trench to the drain. The only purpose of this platform is to furnish a dry bottom upon which the concrete bottom

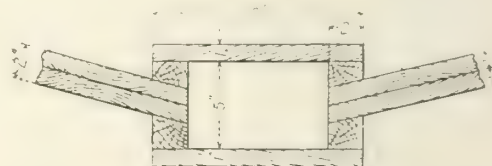


Fig. 2—Part section of box drain and timber foundation, Winnipeg aqueduct.

of the aqueduct may be built and kept dry until it has had time to set. The dimensions of the box drain are shown in Fig. 2. All sections of the aqueduct may be provided with this platform.

Although a double platform is shown it is better where there is but little water to be taken care of to use only one board with grooves in each edge of each board through which the water can pass to the central drain. Both types of plank foundation are shown in Fig. 3. The boards should be bedded in sand. If there are places along the line where a platform will not be kept continuously wet after the aqueduct is

Table 1—Lengths, Slopes, Elevations and Dimensions of the Various Sections of the Aqueduct from the McPhillips Street Reservoirs in Winnipeg to Shoal Lake.

Total Distance from McPhillips St. Reservoirs.	Length of section, ft.	Dimen's of Aqueduct. Height, ft.	Width, ft.	Slope in ft. per 1,000 ft.	Elevation of hydraulic gradient at end of section		Remarks.
					1,000 ft.	ft.	
0	0	.....	.....	.....	.....	41.31	High water in McPhillips St. Reservoirs.
12,000	2.27	12,000	4 ft. diam.	C. I. pipe	0.81	51.03	These slopes and elevations are for a discharge through the pipes of 25,000,000 gals. daily.
56,100	10.62	44,100	5 ft. diam.	Steel pipe	0.37	67.35	
82,100	15.55	26,000	8 ft. diam.	Rein. conc.	0.025	68.00	
56,100	10.62	.....	.....	.....	.....	61.00	Proposed high water in reservoir east of Transcona.
82,100	15.55	.....	8.0	8.0	0.29	68.54	This slope based on 35,000,000 gals. daily.
							Elevation of inside of aqueduct bottom at end of section.
82,100	15.55	.....	.....	.....	.....	83.0	Beginning of grade conduit.
113,100	21.42	31,000	7.5	8.5	0.32	72.92	.....
128,100	24.26	15,000	6.4	7.4	0.70	83.42	.....
141,600	26.82	13,500	5.7	6.4	1.23	100.02	.....
156,100	29.57	14,500	5.1	5.1	2.83	141.05	.....
165,100	31.28	9,000	5.8	6.7	1.00	150.05	.....
229,700	43.54	*64,600	6.6	7.6	0.54	184.93	.....
246,500	46.69	16,800	5.3	5.7	1.90	216.90	.....
262,500	49.71	16,000	6.7	7.7	0.50	224.90	.....
306,500	58.65	44,000	7.4	8.4	0.30	238.10	.....
392,500	74.34	86,000	6.3	7.3	0.69	297.44	.....
445,400	84.35	52,900	7.3	8.3	0.32	314.37	.....
455,400	86.25	10,000	8.0	9.0	0.24	316.77	.....
470,400	89.09	15,000	9.0	10.0	0.24	320.37	.....
503,359	95.34	32,959	9.0	10.0	0.11	324.00	.....
503,400	95.35	41	.....	.....	0.00	324.00	Gate and screen chamber.

*13,000 ft. of this length at Brokenhead River Crossing is 7.2 ft. in diameter and reinforced.

completed, the platform should be omitted because of the liability to decay under such circumstances.

Re-filling and Embankment.—Where pipes are to be laid in the streets, they are to be placed at a depth which will permit a 4-ft. covering of earth. East of Transcona, where the aqueduct will not follow the streets, but be laid through the open country, the much cheaper and more expeditious plan will be adopted of building the aqueduct in a shallow trench—from 3 to 4 ft. deep, where practicable—and covering it to a depth of 4 ft. with an embankment of earth.

It is proposed to make this embankment with a top width of not less than 8 ft. and nowhere less than the inside width of the aqueduct and to make the slopes of the embankment 2 horizontal to 1 vertical.

Aqueduct Statistics.—Table 1 gives various statistics relating to the different portions of the aqueduct, including the lengths, gradients, elevations and dimensions of the different portions.

For a distance of 33,000 ft. from Indian Bay, the gradient of the aqueduct has been made only 11 ft. in 1,000 ft. This low gradient was adopted to diminish the depth of the summit cut. The aqueduct through this section is 9 ft. high and 10 ft. wide.

For the next 25,000 ft. the fall per 1,000 is .25 ft. The large sized aqueduct, 9 ft. high and 10 ft. wide, is continued for 15,000 ft. of this distance and a smaller aqueduct, 8 ft. high and 9 ft. wide, for the remainder of the distance. This design is the result of somewhat complicated hydraulic computations which show that with these sections of the aqueduct as planned 85,000,000 gals. daily will flow through the aqueduct when the water in the bay is 3.75 ft. below high water level, provided the water has such a free entrance through the intake and gate and screen chamber that it does not fall more than .25 ft. in passing through them.

Beyond the three portions of aqueduct above described, the gradient of the aqueduct has been made to follow approximately parallel with the surface of the ground all the way to its end near Transcona, and a

size has been adopted for each gradient, with a few exceptions which would give the aqueduct the standard capacity of 85,000,000 gals. per day.

The quantity of water which will flow through the reinforced section of aqueduct, used for the last 26,000 ft., will not depend upon the gradient of the aqueduct itself, but upon the hydraulic gradient available when a reservoir is built east of Transcona, and its size has been computed accordingly.

Somewhat similarly, the next two portions of the aqueduct east of the reinforced portion, covering a total length of 46,000 ft., have been made a little larger than the size due to the gradient of these portions, on account of the possible back water effect from the reservoir.

The flow through the pipe line is, of course, dependent upon the hydraulic gradient and not upon the gradient of the pipes. For a flow of 25,000,000 gals. daily, this amounts to .37 ft. per 1,000 in the 5-ft. pipe and .81 ft. per 1,000 in the 4-ft. pipe, making a total fall through these pipes to the McPhillips Street reservoirs of 26 ft.

Red River Crossing.—The design provide for crossing Red River with a pipe placed in a tunnel, the tunnel extending about 900 ft. horizontally across the river from a shaft in Victoria Park to a corresponding shaft on the opposite side of the river. The shafts will each be about 75 ft. deep. After considering different plans, one plan was selected which provides for the use of cast-iron pipes 5 ft. in diameter, with metal 1.9 in. thick, provided with a special bell about 15 in. long, so designed as to permit the joint between pipes to be caulked from the inside with lead wool. The tunnel is to be excavated only large enough to permit the pipe to be put in place. This requires that its minimum diameter shall not be less than 6 ft. 3 in. and the average diameter, owing to the irregularities in blasting, will be considerably more. All spaces between the pipe and the sides of the tunnel are to be filled with concrete, as far as it is practicable to place

Fundamentals of an Extended Experience in Sewage Disposal

WHAT may be termed the fundamentals of sewage disposal were considered by Dr. Bosstock Hill, Medical Officer of Health for Warwickshire, Eng., in his presidential address to the Association of Managers of Sewage Disposal Works. The portions of Dr. Hill's address abstracted below was prefaced by a brief reference to the earliest work in this field and by a few observations on the subject of land treatment. In our abstract we have endeavored to present such features of general interest as may be suggestive in Canadian practice.

Preliminary Treatment

It is rare, except in the case of very small communities, for any new scheme of sewage purification to be a land scheme, and so I propose to leave this matter and deal with my experience generally on the various types of treatment in use called bacterial installations. I think we may take it that in the great majority of schemes at the present time the sewage is first of all screened, and afterwards subjected to so-called septic tank treatment. As I have previously stated, we have given up the idea of complete resolution of the organic solids. Not only have we done that, but I think that if we have learned anything of late as regards this preliminary septic treatment, it is that it is extremely desirable to prevent the septicity being carried too far. To a large extent, of course, this depends on the nature of the sewage, and in what I say now I am supposing the sewage to be an average one, consisting, chiefly, of ordinary domestic sewage and refuse. Special cases must, of course, be specially dealt with. It used to be taken as a somewhat general rule that the time sewage remained in the septic tank to undergo its first process was twenty-four hours; but I have definitely come to the conclusion that it is desirable, in the majority of cases at least, to reduce this period considerably, and for a theoretical standard installation I should be inclined, at the present time, to reduce the period of septic action to twelve or fourteen hours. I do not make this suggestion on the ground that nuisance may result to those around from the septic tanks, though this is a question which may have to be taken into consideration, but I refer solely to the production at the works of a good effluent, and I am sure at the present time many managers of works have difficulties to contend with owing to "over-septic" treatment.

Another point which is, I am sure, of great importance, which, of course, has been dealt with, but which has come prominently before my own personal notice, is that of the amount of suspended solids discharged on to the filters. I am not going to touch upon the question of colloidal matter, but I do definitely state that unless the amount of suspended solids are kept down to something approaching 8 or 10 grains per gallon reasonably good results will not be consistently maintained. This practically requires, therefore, that septic tanks must be cleaned out comparatively often, and not left, as was at one time done, as long as possible in order that the resolving action should be maintained as efficiently as possible.

Filters

Next I would come to the filter. I cannot help but be struck by the enormous amount of literature that has been given to the world on this point. My earliest experiments were with coal as a medium, and here I would mention that I still say what I affirmed nearly twenty years ago, that if

it were possible to obtain coal at a price which would compare with other media, no medium is so completely satisfactory as this one. The price of coal, however, of late has risen to such a figure that its use has become an impossibility, and fortunate for us it is—though I still believe coal, when properly used, to be the best of all media—we have plenty of others at our call from which excellent results can be obtained. The question as to what medium should be used in a particular filter depends chiefly on which of the available suitable materials can be the more easily obtained. Slag, clinker, granite, slate and other materials are all quite suitable, though I consider care must be taken in the choice of slag to see that no substance is yielded when treated with sewage that tends to seriously affect the effluent subsequently.

Having regard to modern methods of distribution, I have come to the conclusion that if there is no reason to the contrary, the circular filter is undoubtedly the best, chiefly on the ground that regular, systematic distribution is the more easily obtained.

As regards the amount of available material in the filters, my experience tells me that it is not merely a question of the number of cubic yards available. With a full knowledge of what has been done in a great many places, I am strongly of opinion that there should be a distinct relation between the area and the depth. I admit, perfectly freely, that good results are obtained from filters of very varying depth, but I am equally sure that, under normal conditions, the filter should not be too deep nor too shallow. I am not going to hide behind any such generality as the last sentence suggests. If it be necessary for a filter to have a certain surface area, and if it be made deeper than necessary to effect its purpose, obviously there is a waste of material and an unnecessary increase in its cost. It has been the custom of late to estimate the amount of available material in cubic yards. Personally, I object to this method, though it be official. I am quite convinced that a too shallow filter is not sufficiently effective, however fine the material may be. I do not think we have sufficiently yet taken into consideration the atmospheres of the filters, and I have come to the conclusion—as a result of experiment—that filters under 4 ft. deep are not completely satisfactory. In other words, I do not consider an equally good result can be produced by diminishing the depth and increasing the surface, except within somewhat narrow limits. I have carried out experiments at different works in tapping filters down to 7 ft., and as a result of these experiments, carried out for a series of years, I consider that with normal sewage the standard depth of filter should be 5 ft. Nobody has a higher appreciation of the magnificent work done in the interests of sewage disposal by my friend and colleague Dr. George Reid than I have. We have worked together for many years—more than either of us care to remember—and of all the difficulties and problems which have arisen, in only one, as far as I know, do we not see eye to eye with each other. He has been—of late years at all events—an advocate of the shallow filter. While not being an advocate of the deep filter, I am convinced that under normal conditions the best results are obtainable in one of medium depth. I am quite conversant with the splendid attainments at Hanley and some other places in Staffordshire. My knowledge of the work is not superficial. For a period of over twelve months I analysed the Hanley sewages and effluents monthly, and I know therefore what results are constantly obtained there, but

with this knowledge, in the light of information I have of other sewages, I say that while the results obtained at Hanley are consistently good, the same results could not be definitely and certainly attained under like conditions in the majority of other places. The conditions in North Staffordshire are peculiar; the sewage is more or less weak, and there are other physical conditions of the sewage which make for purification, and thus permit of less work being done by the filters to achieve a thoroughly satisfactory effluent.

As regards the size of the particles of medium, I have come also to very definite conclusions. My first experience of biological filters was made with coal, and here the particles used were extremely fine, going down to 1-16 in. As a result, however, of further experience with media other than coal, I am inclined to think that, taking average sewages with a filter 5 ft. in depth, probably the best average results are obtained with a medium the particles of which are about $\frac{1}{2}$ in. in size—perhaps with a little finer material on the top. I have satisfied myself that, under ordinary conditions, such a filter will last for a very long time without any diminution of its powers of taking and purifying sewage. I have also satisfied myself that one of the causes of trouble in fine grain filters is that the material often contains finer particles than those specified, and I have had experience of trouble arising from this cause. An ordinary streaming filter is, to my mind, best graded to some slight extent—namely, a few inches of larger particles at the bottom, these followed by particles reaching $\frac{3}{4}$ in., the bulk of the filter, however, being of $\frac{1}{2}$ -in. particles. I am quite aware that my friend Mr. Watson, whom I acclaim as one of the leading authorities on sewage treatment in the world, does not quite agree with me. I remember his telling me once, when he was putting down the large acreage of beds for the Tame and Rea Drainage Board, that with so large an area he would not sleep in his bed of a night if he felt there was a danger of the filters choking up. I sympathise with his fear, but I do not agree with the risk that he imagines. Personally, I have satisfied myself through a long series of years that, given reasonable precautions, such as may now be said to be standardised, there is no more danger of a small grain filter than of a large grain filter becoming occluded by sewage. Some experiments carried out by Dr. Reid, in fact, point quite in another direction, and though I have under my supervision a very large number of filters with fine medium, I have never seen any more danger than in the case of the filters in which the particles are large.

As regards the quality of the effluent, in my experience there is no comparison between the two; if, however, it be desired to treat on a filter a larger quantity of sewage than the filter should be required to take, then I admit that apparently a better result is obtained, and possibly, under some circumstances, a sufficiently good result, taking into consideration the requirements of the district.

Final Effluent Treatment

A point which has struck me in my own personal experience is the value of running effluent into large shallow lagoons before discharge into the streams. It always seems to me that, where circumstances permit, this is a very desirable procedure.

If the medium of which the filter consists is formed of large particles, humus tanks are undoubtedly absolutely necessary, while I am inclined to think that, even in the case of fine grain filters, where the sewage is strong, the institution of such tanks is distinctly advantageous. In many places where the effluent is otherwise excellent in character—that is, nonputrescent and well oxidised—it may then be found containing at certain times of the year 5, 10, 15, or more parts per 100,000 of suspended matter. I have hardly seen any case where this could not be materially reduced, almost if not quite, to the figure suggested by the Royal Commission, by suitably constructed humus tanks.

A word or two as to distribution. I have before stated that Mr. Garfield and myself instituted the first streaming filter with mechanical distributor—a form of spray. This, of course, was long before the days of the present satisfactory mechanical distributor. Let me say, however, that I am by no means in favour of sprays. They were valuable as a stage in the evolution of scientific sewage treatment, but I consider their day has passed. The Royal Commission apparently are in favour of mechanically driven distributors, and no doubt very excellent results can be obtained by these; but, on the other hand, the experience of the last ten years is conclusive to my mind that such distributors are by no means essential. Good results can be obtained with a minimum of nuisance or smell, which need not extend beyond the works, by ordinary distributors, supposing the scheme be a properly designed one.

Tests and Standards

Another point which has come prominently under my notice is the question of the testing of the quality of effluents as discharged in a county where much sewage work has been done, and where many samples are obtained each quarter, a vast amount of experience has collected, and suffice it to say that even before the Report of the Royal Commission expressing its opinion as to the tests which should be applied to effluents, I have myself become perfectly satisfied with tests previously available. I carried out, at the request of the Royal Commission, a series of tests for dissolved oxygen in effluents. With care and experience I believe that such tests may be applied with a fair degree of accuracy; but, after allowing this, it seems to me that the nature of the test is such that it can hardly be considered applicable for the use of the sewage manager under ordinary conditions. Neither do I think that the results obtained are commensurate with the difficulties and time taken up by the test. Personally, I am perfectly content to form my opinion as to the polluting character or otherwise of an effluent by the amount of suspended matter in it, the amount of oxygen absorbed in four hours, and the quantity of nitric nitrogen. I am also in the habit of carrying out incubation experiments, and of estimating the free and organic ammonias; but though these are useful, and no doubt afford a certain amount of additional information, the three tests I previously mentioned, speedily and easily applied as they are, appear to me to be the most applicable for general use. But in judging of the character of an effluent, what we have now to consider largely is the question whether or not the amenities of those living near or having rights in the stream are respected, and the very simple test, applicable in nearly every instance, of allowing the effluent to flow in and out of a tank in which ordinary coarse fish are kept, is, in my opinion, one of the best, and at the same time an object lesson to the public. In many of the works I supervise this fish test is carried out. If the fish remain for months alive and well, obviously there is nothing passing into the stream which is likely to be fatal to fish life, while if anything happens to them the daily inspection of the fish tank will in itself be an intimation that the matter requires investigation.

Nuisances From Sewage Works

In addition to the works with which I have been associated for the purification of sewage, it has been my lot to have been engaged in a considerable number of actions at law in reference to nuisances from sewage works. In the pre-bacterial days many actions took place on the ground that nuisance was caused by sewage farms to residents in the neighbourhood, and when this was so, it was nearly always due to the neglect of some reasonable precautions in the reception of the sewage, or with the way it was dealt with on land. In the case of normal sewage, nuisance rarely occurred unless the land was unsuitable in itself, or the sewage was

applied in such a way that lagoons of crude sewage were formed, which, in hot weather, gave rise to nuisance.

When bacterial installations first came into vogue it was felt that the septic tank might be a nuisance, and care was taken in the early installations to cover such tanks completely in. In fact, it was laid down that the covering in of the tanks was almost a necessity. Later, however, it was found that, except under special circumstances, where such tanks were close to buildings, this precaution was unnecessary; but for all that, troubles even of late have still arisen under special circumstances. In the hot year of 1911, when the temperature in the middle of the summer was very high for many days, conditions arose which produced nuisance under many circumstances hitherto unsuspected. Similar conditions have arisen in cases where the sewage to be treated is of a special character; for instance, when it contains much brewery, tannery or fellmongers' waste. In the case of the huge installation of the Birmingham, Tame and Rea Drainage Board, a serious nuisance occurred for a long distance around the works in the summer of 1911, and this required special treatment in deodorising the sewage so that nuisance might be avoided. Difficulties have also occurred at Stratford-on-Avon, Nuneaton and several other places, and it has been found necessary under these special circumstances, whether of character of the sewage or meteorological conditions, at times to deal with the sewage to prevent undue putrefaction. Mr. Watson, at Birmingham, found that a minute quantity of hypochlorite should be added to the sewage, which would prevent the nuisance arising from the fifty or sixty acres of sewage bed without in any way interfering with the bacterial treatment of the sewage.

It is obvious that when a new state of conditions comes into operation, unexpected difficulties will arise, and I quote these cases as evidence of the amount of skill and experience necessary in those having to deal with such works.

Difficulties in Treatment

I may also mention here two interesting cases which came under my observation of unexpected difficulties occurring in bacterial installations in rural districts. A bacterial plant was laid down, and dealt quite effectively with the sewage of the community. In a short time, however, a new gasworks was laid down in the rural district for the supply of a neighbouring city. The waste waters from this gasworks were turned into the sewers, and in a very short time after the works were opened the beds were absolutely and completely sterilised. Efforts were made to so deal with the waste that its deleterious effects could be neutralised, but with no effect, and the waste gas washings had to be taken from the sewer and diverted elsewhere, when, in course of time, the efficiency of the beds was restored. In another case, a most excellent works, up to date in all respects, received, at times, waste from a large tannery, with the result that, despite effective tank treatment, so much animal solid matter got on to the beds that they were rendered useless. Here, again, by dealing specially with the waste matters before discharge into the sewer, the efficacy of the plant again became normal.

Necessity for Extensions

When a local authority has spent a considerable sum of money in laying down a plant for dealing with sewage, and both the members of the body and others concerned are satisfied with the results produced, it is extremely difficult, I have found, to get the body to understand that if a rapid increase of population takes place a corresponding increase in the means of purification must also be effected. Even with every desire to do what is necessary, local authorities are apt to allow their plant to become somewhat ineffective, by not taking steps sufficiently early to increase its power as re-

quired. I know of a city whose population increased in fifteen years from 58,000 to over 100,000. The sewage works were originally well adapted for their purpose, and did excellent work. Though extensions were made, they were not made as fast as the increase of population occurred, with the result that the continued deterioration of the effluent and of the river into which it flowed became marked. Nothing is so uneconomical as overwork, whether it be of the individual or of a scientific plant, and it is important for all those connected with sewage works management to be ready to grasp the situation and advise as to the importance of extensions being made before they are proved to be absolutely necessary. Before I pass away from this part of the subject I should just like to call attention to one other matter. That is, though we now generally understand the purification of sewage to be due to biological processes, we are still apt to consider that the forces at work are chiefly micro-organisms. The work, however, which has been done by some of the members of this society—and particularly Mr. Bell's work on "the influence of podura on the efficiency of action of filters"—is so marked and so important that in any resume brought up to date it should not be left without mention.

Importance of Good Management

An important point is that of good management. In a recent report I called attention to the management of sewage works, and stated as follows: "Every year I supervise the work of sewage disposal plant I become more imbued with the idea that the crux of the matter is the question on management. Works constructed in the most scientific manner, with every up-to-date appliance, will, if not efficiently managed, frequently become ineffectual; while, on the other hand, given good management, a small area of land, or secondary bacterial installation will often produce a good result. It is very unfortunate that many bodies do not grasp this fact. They spend considerable sums in laying down works, and appear to think that these should go on automatically. As a matter of fact, much expense is entailed by forgetting that management is equally important with good construction of works. It is obvious that scientifically designed plant cannot be with safety left to a labourer; and yet in some instances I have known this to be done, and works originally well designed be blamed for the unsatisfactory results obtained."

As in the case of human beings, what is continually sought for is the "mens sana in corpore sano," so the ideal for reaching the best result in a sewage works should be the attaining of the scientifically constructed works, dealt with by a conscientious and well-skilled manager.

The Thirty-Fourth Annual Meeting of the American Waterworks Association is to be held in Philadelphia, Pa., May 11 to 15 next. Particulars of the meeting may be obtained from the Secretary, Mr. J. M. Devon, Troy, N.Y.

The next issue of the Contract Record and Engineering Review (March 5) will contain a report of the annual convention of the Ontario Good Roads Association, which is now being held (February 24 to 26) at the York County headquarters, 57 Adelaide Street East.

Messrs. Langman & Williams, architects, have opened an office at 194 Carlton street, Toronto. The partners are Mr. Percy Langman and Mr. E. J. Williams. The former was associated for some time with the Provincial Works Department at Toronto and at an earlier date with Messrs. Langley & Howland, while Mr. Williams has been with the Dominion Realty Company and the Hydro-electric Commission.

Problems of the Waterproofing Engineer

Why Concrete Needs to be Waterproofed—Up-to-date Methods Discussed —Decoration of Exterior Concrete Walls and Treatment of Cement Floors

Contributed by Wm. H. Evans*

IT is surprising how many engaged constructively in the building world are unfamiliar with the up-to-date methods of decorating and waterproofing concrete structures, and because of their unfamiliarity in many cases have pasted concrete up. There are many reasons for placing concrete ahead of any other building material, but the writer will only dwell on the three above-mentioned subjects.

In the issue of the Contract Record for February 11, Mr. Gresser contributed a lengthy article on the same subject. As several of his statements were very strong and to my mind (unintentionally) misleading, I am forced as a practical waterproofing engineer to write this article pointing out to those who have read his contribution the other side of the story. I trust that readers as well as Mr. Gresser will carefully consider my arguments.

His introductory remarks were correct. Cement construction does require great care. Unfortunately the impression has gone abroad that it requires only unskilled labor to erect concrete structures. That ordinary laborers are used in concrete work, while in brick structures high-priced bricklayers would be required, is quite true, but the real difference comes in where the superintendent is concerned. The man in charge of a bricklaying crew owes his position to his success in getting work out of his men, which is all that is required of him, as the materials are of such a nature that all they require is careful laying-up to develop their entire strength. Such a foreman would be absolutely worthless in charge of concrete work, for his "hurry up" methods are not conducive to the best results.

There is nothing problematic about the strength of good concrete any more than there is about the strength of brick or stone. The only trouble is that we must assume the work will be well done, and this only good, intelligent supervision will accomplish. If the work is not properly done, or if through ignorance or carelessness poor materials lacking in strength are used, the concrete will be brought to naught, just the same as if sun-dried bricks were used instead of granite, or wooden beams were substituted for steel girders. It is in the construction end of the building wherein the greatest responsibility lies, and here the utmost experience and skilled supervision is needed; in fact one poor batch of concrete might mean disaster to a structure.

Many arguments have been raised against waterproofing compounds and liquids. It is a recognized fact throughout the entire construction world that materials which are to enter a structure under the process of erection should be tested. Waterproofing, probably more than any other material, demands this attention. First, because as a matter of fact there are so few who really know what the results of the conditions imposed will be. Second, because of the wide variation in the many brands of waterproofings, and even between the different batches of the same brand.

Third, because there are still on the market a few unscrupulous dealers who are not as careful of the products they put on the market as they might be.

Architects and engineers, as well as the public, may be pardoned if they have failed to realize the wide influence which has been exerted in recent years by the leading waterproofing companies, not only in matters relating to their specifications, but also in the development of ideas for the safety, help and comfort of the public. Their failure to realize may be easily explained. On the market at the present time are hundreds of brands of waterproofing, all claiming to be the right one, with prices ranging from four cents to fifteen cents per pound. The practice of most manufacturers, apparently is to sell their products, get all there is in it, and get out with their profits before their products have had a chance to fail. Architects, engineers and the public have been stung so often that they have become sceptical, with the result that the real ones have had hard times in gaining recognition. We take issue with Mr. Gresser in his statements that waterproofings, compounds or liquids, when added to the cement will weaken the mass and cause it to deteriorate and affect the re-inforcing. Mr. Gresser was probably referring to the less reliable brands of waterproofing, because I can prove to him and readers of the Contract Record that there are waterproofing compounds that have been put on the market after years of research work, that will waterproof concrete absolutely, and instead of causing the concrete to deteriorate will increase the tensile strength. The result is imperishable concrete structures.

The part that cement plays in concrete construction is the most important one. Its work starts when the water is added, and it plays the part of a medium for uniting cohesively and adhesively members of masonry and aggregates of concrete, but it is not capable of carrying its part and, therefore, must have an assistant, because the value of Portland cement as a medium for uniting cohesively and adhesively members of masonry and aggregates of concrete lies wholly with its colloids. These latter are the glues or jelly-like crystalizing properties that are contained in the substance of the cement clinker, and which are set free by the water. As this is insufficient to secure impermeability, it is the cause of the more or less common belief that Portland cements are incapable, by themselves of producing non-porous, waterproof and damp-proof work. If we look around us we will see the truth of this, wherein as already stated, the value of Portland cement lies wholly with its colloids; and as the cement does not contain sufficient colloids to secure waterproof concrete, we will have to call to its aid a mineral substance in a true colloid composition, which when added to the cement will produce perfect water-tight concrete construction. The mineral substance will have to be in the form of a waterproofing material. It may take some time for this idea to fasten itself upon the minds of those who are engaged constructively, but in the end it will be ob-

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vicious for those who have followed cement waterproofing from its inception know that a chemical must be added to the cement that will assemble the aggregates into a dense body before it is waterproof.

A great many are under the impression that only cheap construction needs waterproofing, and that the use of high-grade materials and workmanship will assure water-tight results. The results are produced by such methods in just enough cases to give some color to the theory that this method is a safe one, but investigation of any considerable number of such instances will show clearly that the waterproof result is the exception and not the rule. Having proved that waterproofing precautions are necessary, the next question is the method of waterproofing to be used. There are two methods of attacking the problem. The membrane method which derives its name from the manner in which the continuous elastic, impervious sheet of bituminous material or patent compound surrounds the structure to be waterproofed. The materials used for this form of waterproofing are coal-tar pitch, asphalts, asphalt mastic and specially-prepared compounds. The pitch and asphalt are applied hot in the majority of cases, and where severe conditions are to be provided for, layers of felt or burlap are used with the preparations, and as many as seven layers. For the exclusion of ordinary dampness two or more coats of the preparation without the felt may be used directly upon the surface to be protected.

The membrane method is easily injured during construction. If punctured by accident, or disintegration later by the earth fluids, water is likely to penetrate the wall many feet distant from the actual break, and the membrane can practically never be reached and repaired. The membrane method calls, in some cases, for expensive protective or retaining walls, requiring additional excavation and taking up valuable space. All this is unnecessary where an integral or a waterproof cement facing is used.

The integral method takes its name from the meaning of the word, the waterproofing material becoming part of the whole, and the entire mass of concrete or mortar being affected throughout, as distinguished from the use of a separate and individual protective coating. The effect desired is produced by properly grading the aggregates themselves and then adding special preparations in the form of liquids, pastes or powders, either to the water used in mixing the concrete or to the cement before wetting. A further extension of the integral method might include the application of waterproofed mortars to ordinary mass work, where the mortar coating becomes an inseparable part of the mass. It must not be surmised that an integral waterproofing material will make a poor or lean grade of concrete waterproof, although it may serve to render it less susceptible to ordinary dampness.

The success or failure of any firm, and their plans and reputation, depend more on the people entrusted with their work. To entrust waterproof work to common laborers under the impression that it is rough work anybody can do, is to invite failure.

Waterproofing is usually an engineering problem required patience and painstaking methods, without which no system has ever been able to effect reliable results, yet any experienced cement worker can perform the work if he will use his head with his hands, and will stand for nothing short of thoroughness in the preparation of his surfaces, selection of ingredients and in the workmanship. Several of the reliable

manufacturers will take your contract to waterproof, damp-proof, decorate the concrete walls for waterproofing, treat cement floors for dustproofing. As an alternative they will send one of their engineers who is well-trained on the subject to supervise the work at normal cost where the work is not done by them, and in both cases will guarantee the work, which proves their faith in their materials. Many are under the impression that their buildings do not require waterproofing above grade, especially concrete buildings. To this I will reply that when concrete breaks down, (in the majority of cases it happens in the winter and spring), this is due to the fact that concrete absorbs moisture which freezes and expands, then it thaws and the obvious result is a disintegration of the concrete, frequent crumbling and the appearance of large cracks as the water forces itself to the surface. This is especially true in retaining walls, abutments, etc. It also explains why the interior of buildings is frequently damp, even when built of hollow-tile blocks. The reason why concrete sub-structure walls hold better than elsewhere is because the walls are below grade. The water may seep through these walls without materially injuring the concrete because it does not freeze.

Conditions to Provide for in use of Porous Materials

In the use of porous building materials there may be two conditions to be provided for in keeping out water or dampness. First, water pressure to be resisted, and actual entrance or percolation of water prevented. Second, a gradual absorption of water by the materials, due to porosity and capillary attraction. While water may not seem to be present in the material upon inspection of visible surfaces, it is nevertheless present and is being constantly evaporated away from the surfaces in contact with moving air. A concrete wall may give out dampness to a room even if the material is of such a nature that percolation of water through the wall does not actually take place. Provision against the first of these conditions is commonly referred to as "waterproofing," while protection in the second condition is called "damp-proofing." While on the subject of waterproofing as it pertains to concrete I will cite the precaution necessary to make the structure sanitary, dry and a healthy place in which to work or live. Possibly the first consideration should be that of the location in which you are going to build. It goes without saying that if we dig a hole in low ground, the hole will fill with water, either when dug or after the first spell of wet weather.

A cellar placed in a similar location would be subjected to the action of water varying from a perceptible water pressure down to ordinary dampness, depending upon the ability of the surrounding earth to carry away the water. Such a cellar should be provided with integral waterproofed concrete walls and floor, in such a manner that water will neither enter the cellar nor be transmitted to the building walls above. The side walls of the building above grade should be constructed in such a manner that water from storms will not be absorbed and pass through into the interior of the building. This can be done by applying two heavy coats of a damp-resisting paint of such a nature that when applied it will remain tacky and form a perfect bond for the plaster.

Whenever moisture penetrates a piece of reinforced concrete, the corrosion of the reinforcing member is absolutely certain to result, and the corrosion once established contains within itself the elements of an unending existence while moisture is present. Then

follows the breaking of the bond between the metal and the concrete, the weakening of the structure, cracked and sagging floors, insecure dams, unsafe retaining walls and general decay. Concrete has come to stay, and waterproofed concrete is the best method of construction ever devised by man; it is fireproof, sanitary and practically indestructible.

There is only one way to do a thing right, and that is to do it right from the beginning. Work, worry and repair may make a bad job better, but they never made a bad job good.

It is especially true in concrete construction, where the work was apparently well done, the mixture was right and the weather conditions ideal to produce a lasting, permanent concrete structure, and yet within a few years the structure or retaining wall has failed. Ask the engineer the reason and he will invariably tell you it was due to the porosity of the concrete. Frost and water have done their deadly work and in many cases new structures are necessary to replace the old.

Take the cost of the failure, the cost of repairs, or the cost of a new structure, and figure it out yourself. It would have cost a little more in the first place to have built the wall or structure of waterproofed materials which would have defied the ravages of frost, but once built they would have been as lasting as the Rock of Gibraltar. No repairs, no expenses, no dangers.

Waterproofed concrete cannot take up any appreciable amount of water, and consequently cannot freeze and expand with resultant disintegration, crumbling and cracking. Practically the only other cause for the disintegration of concrete, besides its permeability is inferior cement. The durability of concrete depends wholly on its density and hardness. Density is the word that every architect, engineer and cement user should have illuminated on an electric sign over his desk and underneath should be "colloidal waterproofer;" the greatest densifier in the world, because it is cement's assistant in the wonderful play called "perfect concrete," and the honors belong to the manufacturers whose days in the dark were spent in a vast amount of research work to invent the lacking material to be incorporated into the cement that would not weaken the tensile strength, retard or accelerate its action.

The colloidal waterproofer as described above has a past, present and future. I have successfully waterproofed many substructures where the water pressure was severe. The structures are bone dry to-day, and show no signs of deterioration as Mr. Gresser claims waterproofing materials will do. It is at present being successfully used all over the country by architects, engineers and cement users, who after careful investigation have recommended it for their waterproofing work. Its future cannot be anything but a success as the architectural and engineering profession is duty bound to specify materials of merit. Others will follow their footsteps, and by so doing will use a material that has made for itself a "universal success."

Decorating concrete has met with many failures which can be easily explained. Concrete surfaces exposed should not be decorated until the surfaces to be painted have aged six months. The concrete carries moisture up to that age; any paint applied to the exterior of a concrete surface before that time will be lifted from the surface by the moisture working its way to the moving air. The alkalis in the cement will

destroy the vehicle and cause the paint to flake from the surface. To obtain perfect decorated concrete surfaces the following, if carefully followed, will give the results: First, see that the concrete is properly aged. Second, that the surfaces to be decorated are perfectly dry. Third, first apply a priming coat of a material of a cement body and a china-wood oil vehicle. The primer penetrates into the voids in the surface and fills all the fibrous channels which would otherwise allow the percolation of seepage water. After this priming coat has dried for forty-eight hours in good drying weather, second coat with a cement paint carrying the same vehicle. These materials can be obtained in open market in many different shades and are manufactured by leading waterproofing and damp-proof concerns that will stand back of their materials.

Cement floors, no matter how carefully prepared, will dust; oil and grease will penetrate the surface and cause the cement to disintegrate. The treatment of cement floors has passed the infancy stage. Thousands of cement floors have been made dustproof, oil-proof and waterproof all over the country, and it is a recognized fact that cement filler and cement floor paint as manufactured by reliable concerns are staple. Their trial has ended, and for the benefit of those who are not familiar with these materials I will say that they have been successfully used in garages (where heavy automobiles with chains on the tires are constantly running over them), hospitals, hotels, power houses, office buildings, loft buildings, school houses, sugar refineries, printing establishments, and in hundreds of other types of buildings with an unbroken success. In the Woolworth Building, New York City, the tallest and largest office building in the world, the floors are painted. The World's tower building, the tallest loft building in the world, have the floors painted, the St. Lawrence Sugar Refineries, Montreal, have the floors painted and dustproofed. The Panama Canal Commission have used thousands of gallons. I illustrate the above structure so that my readers can verify my statements. My experience has been vast and practical; some of the largest and most difficult waterproofing operations have been successfully made watertight under my supervision, and by the methods above described. So you, my readers, are taking no chances by following my methods, and I can assure you that your troubles with waterproofing, decorating and dustproofing of concrete will be ended.

The Canadian pavilion to be erected at the Panama-Pacific International Exposition, to be held in San Francisco next year, will be the largest exhibition building ever erected by the Canadian Government. It will be 340 ft. long, 240 ft. wide and 50 ft. high, and the total expenditure upon building and contents will amount to about \$600,000. Mr. George Freeman, a London architect, is designing the structure.

In places where public water supplies are available, little or no attention need be paid to the quality of the water for concrete, but in cases where water has to be drawn from streams or lakes careful examination should always be made. Manufacturing effluents, sewage, and slime are always prejudicial to concrete, and where poor results follow the blame is not infrequently laid on the cement instead of on the unsuitable character of the water.

An Analytical Study of Composition Flooring Material

By H. M. Hooker, Pittsburg

THESE notes are the issue of a two years' investigation of composition flooring involving a personal study of work and manufacturing methods in the United States, Germany, France, England, Belgium and Austria. They aim in some measure to serve two main purposes, to spread more accurate information as to composition flooring and its characteristics, and to provoke and stimulate a much more careful and scientific study of flooring problems.

For the last half century an improved flooring and surfacing material has been steadily sought in every civilized country. Many chemists and workers in Germany, in the United States and in other countries have seen bright prospects for progress in the use of magnesia cement products, and particularly in Germany have worked with varying success toward a more and more perfect flooring surface. The result is the so-called composition flooring that is rapidly extending in use to-day.

History

The history of this material, like that of many another, has been one of apparent early success, failure, disappointment, advance and ultimate commercial success. The basic process was worked out, or at least given to the world, in 1866, by Stanislaus Sorel of Paris, France, who then took out patents on a cementing material composed of magnesia and chloride of magnesium as the two chief ingredients to which other powdered substances could be added. Somewhat later "Sorel Stone" was widely hailed as a valuable addition to the building resources of our own and other countries. Experience and use, however, make it clear that the weathering and enduring properties necessary, particularly for exterior use, were missing and Sorel Stone failed of its early promise. It was not there with the staying qualities. But chemists, manufacturers and workers had been given a suggestion, a working basis for study, experiment and effort. From Sorel's basic compound they have developed a permanent floor surface by the addition and treatment of different ingredients. Some 120 different chemicals and some 88 formulas have been tried out commercially in this country alone. It is mainly due to the German chemists, however, that a really desirable commercial material has been evolved. Gradually, through improvement, failure and again improvement, the border between a doubtful and a really desirable flooring material was crossed. This occurred about seven years ago, and since that time most of the German manufacturers, and there are now 150 of them, some of the English and the American manufacturers have been furnishing a durable, desirable material.

General Description of Composition Flooring

Composition flooring is a light-weight, fireproof, resilient covering. It is laid plastic, usually about 1/2 in. thick, and sets in a few hours into a seamless, tough, warm and rather quiet mass; in appearance and feel not unlike high-grade battleship linoleum. Its jointless character and comparative freedom from cracks due to warping, uneven settlement and vibration of

buildings give it special sanitary value. It is laid over wood, metal, or concrete, and adheres firmly thereto. It appears in many colors and combinations of color from black to a light pearl gray. Probably 98 per cent of the work, however, is red, buff, or gray. In general, colors other than these three are utilized for borders, ribbons and special designs only. Mineral pigments are used almost universally, and, except in the blues and greens, the colors are fast. Blues and greens in the course of years fade to much lighter shades than when first installed. This fading detracts somewhat from the appearance of the work, but does not accompany any appreciable deterioration in wear or life.

Field of Use and Usefulness

From the start magnesia cement flooring has attracted attention primarily because of its sanitary qualities. These it combines with a warmth, resilience and degree of quietness not possessed by concrete, tile or terrazzo. It was first installed in hospitals, schools, asylums, public and semi-public buildings. Its use in buildings of this character has extended more and

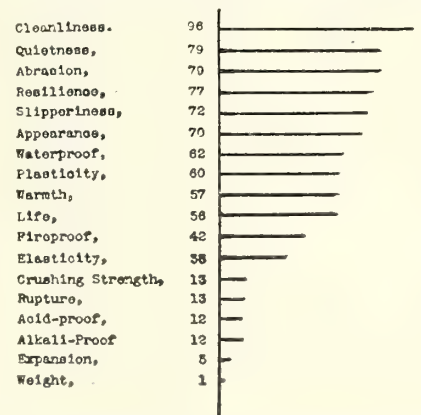


Fig. 1.—Relative importance of eighteen floor properties.

more rapidly during the past few years so that there are to-day probably not less than 6,000 such installations in this country. It was then laid and tried out with a favor that has steadily gathered momentum in other places where cleanliness has been a chief desideratum. I refer to restaurants, dairies, candy factories, hotels and the service parts of residences.

To enumerate all of the classes of buildings in which it has been used with some satisfaction would be to mention practically every type of fireproof building in existence. The following are, however, types in which it has to date demonstrated great usefulness: hospitals, schools, institutions, power plants, stores, dairies, restaurants, hotels, industrial plants, firehouses, garages and the service parts of residences.

It is extensively used for wainscot, base, both treads and risers of stairs, trim and even ceiling. It is as a flooring, however, that such a material is subjected to the severest use, and for this reason the discussion will be concentrated upon its floor value.

Manifestly the usefulness of any flooring material rests in its physical characteristics and properties. The engineer or architect who chooses wisely narrows

his option to proved materials. He then applies common sense and makes a more or less thoughtful, considered selection of the material which will, according to the data available, best answer his purposes. If he has been even slightly thorough he has faced many factors, each of inconstant value, varying with the use to which the flooring is to be subjected, but each of which must none the less play its part more or less consciously in the final determination. What are the properties that he must weigh in an even semi-scientific appraisal? I find no less than 18 important factors. They are: 1—cleanliness—sanitary characteristics; 2—quietness; 3—immunity from abrasion; 4—resilience; 5—immunity from slipperiness; 6—appearance; 7—degree waterproof; 8—plasticity; 9—Warmth—thermal insulation; 10—life—immunity from deterioration with age; 11—degree acid-proof; 12—degree alkali-proof; 13—fire-resistance; 14—elasticity; 15—crushing strength; 16—structural strength; 17—immunity from expansion and contraction; 18—lightness.

Under some conditions appearance is of prime importance; under others, cleanliness; under others, freedom from abrasion. But for the great majority of flooring conditions the relative value of each factor corresponds to its place in the above list. A closer relative valuation is to be found in Table No. 1.

The above table represents a valuation placed upon each characteristic after weighing it under 14 standard conditions of use in restaurants, toilets, factories, hospitals, schools and residences. No doubt every thoughtful appraiser will use slightly different figures. The general results, I believe, closely approximate those here given.

Comparison of Composition Flooring with Other Standard Materials

In the discussion 19 flooring materials have been ranked in 18 different relations. But what, summing

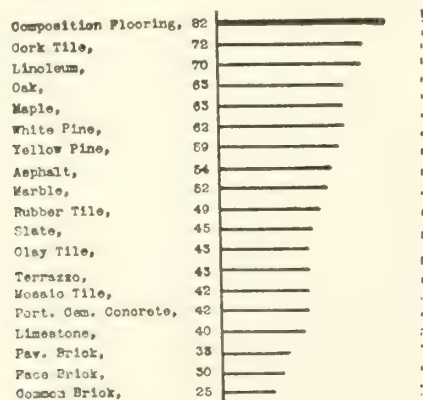


Fig. 2.—Relative values of nineteen flooring materials for average conditions regardless of cost.

it all up, is the relative worth of each flooring material under conditions of normal usage? What value must we assign to each? Manifestly, the figure will vary with the use to which the floor is to be subjected, and any floor problem should be weighed with its special conditions in mind. Most floors will approximate one of the fourteen types already discussed. In that event if my appraisals are just, the computing of the value of each flooring material for the place is merely a matter of arithmetic. (See Table No. 2.) These data yield the following batting averages:

At the first glance it may be somewhat startling to note that even regardless of cost composition flooring

ranks above all competitors and some 9 per cent. above cork tile, its nearest rival. Were it a freak, or an old material adapted to a new use, this would be indeed surprising. But under the conditions of its birth and growth it is but natural. Composition flooring is the issue of prolonged scientific effort. The properties most to be desired in a flooring were repeatedly determined and checked by analysis, observation and experiment. A wide range of materials possessing these properties was assembled in different proportions. The synthetic building up of a composite material possessing a happy blend is the outcome. Composition is the result of a successful attempt to jump its competitors' liabilities while bringing their assets into chemical bond. It is not the product of one brain or of

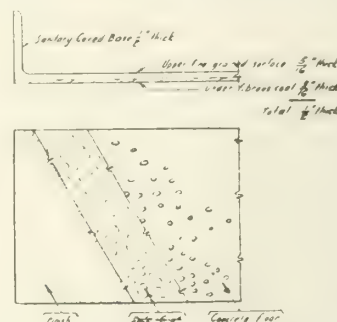


Fig. 3.—Typical composition flooring and base installation on concrete floor.

one year, but the issue of a number of years of effort on the part of several hundred chemists and several thousand workers under varied conditions in many countries.

Conclusion: Composition flooring is the issue of scientific effort to incorporate in a flooring the physical characteristics most to be desired for any given conditions. It is already a valuable material. Like steel, concrete and artificial slate for many purposes, it is of greater value than any of its ingredients. How rapid its extension in use will be and what integral improvements the future has in store depend upon many factors. Practically everyone who has given it careful study is convinced that it will soon be generally recognized and extensively used as one of the valuable, standard building assets of this country and the world.

According to a statement made recently by Sir Donald Mann, the agreement between the Canadian Northern Railway and the city of Vancouver, in regard to the taking over of False Creek and developing it as the Pacific Coast terminus of the company, will be carried out as it stands. The company is not seeking any amendments to that agreement, and the bargain will be completed within the time stipulated, which is now only a little over four years. Sir Donald further stated that the company would enter the city over its own road, although no definite location of the route had yet been decided on.

The 1913 output of cement in the United States is estimated at 90,000,000 bbls. Some energetic statistician has stated that this would fill 529,000 freight cars of 30 tons capacity. These cars, consolidated in one train, would reach from Portland, Me., to San Francisco and from San Francisco to Los Angeles. If these 90,000,000 bbls. were all handled in sacks it would mean, of course, 360,000,000 sacks of 95 lbs. each. If these were set end to end they would go around the world about six times.

Types of Hollow Tile Fireproofing — Their Manufacture and Burning

INTERESTING observations on the above subject were contained in an informative paper read by Mr. Millard F. Gibson, Ceramic Engineer, National Fireproofing Company, at the annual convention of the Canadian National Clay Products Association on January 29. Having outlined the heads under which he proposed to discuss the subject, Mr. Gibson said:—

The manufacture of hollow tile fire-proofing becomes extremely intricate for the factory man because it is an operation that is almost impossible to standardize. The complexities will be readily appreciated when it is understood that a factory equipped to cater to the demands of the trade must manufacture from two hundred to three hundred different shapes and sizes ranging in dimensions from 1 in. x 12 in. to 16 in. x 12 in. and including lengths from 2 in. to 40 in. If the field of fire-proof house construction is entered an additional fifty to seventy-five shapes and sizes will be added, making a total of three hundred to four hundred and the total number of dies required from one hundred to one hundred and fifty.

There is seemingly no absolute limit to the demands imposed on the manufacturer, as the necessity for new shapes is continually arising owing to difficult and necessary steel framings, and the demands of architects and engineers for material for new uses to conform to certain required standards. In consequence it will be readily seen that the constant change in trade demands necessitates a constant making of new dies, and an adjusting of old ones and this lessens the possibility of systematizing the clay preparation, general shop practice and particularly the drying and burning treatment.

Type of Body Desired and Clay Preparation

These two operations—determination of type of body desired, and clay preparation—are dependent one upon the other, and in consequence it will be appropriate to consider them in conjunction with each other.

Hollow tile fire-proofing is specified as: 1, dense; 2, semi-porous; 3, full porous, and the fully equipped factory is capable of producing all three types. Dense hollow tile bodies are those in which the body is to all intents and purposes as nearly vitrified as possible. Semi-porous hollow tile bodies are those to which a proportion of some carbonaceous or bituminous substance has been added that will burn out during the firing treatment leaving minute open cells in the body. Full porous hollow tile bodies are those to which have been added a proportion of bituminous matter as large as the plasticity of the clay will allow. In many cases full porous bodies are specified 25 per cent. to 40 per cent. meaning that these percentages of the total volume of a cubic inch of the body shall be voids. The only method in vogue at the present time to produce such a ware is to introduce the required percentages by volume of the clay mixture of some carbonaceous matter that will burn out. The carbonaceous and bituminous anti-plastics usually added may be saw dust, manure, fine straw, coal slack, ground coke, etc.

In determining the type of burned body required consideration must be given to the uses to which the finished pieces will be put. It is necessary to determine: 1, what will be the crushing strength per sq. in. net area of the burned piece, net area meaning only the solid portions of the hollow tile, exclusive of the cells; 2, weight per cubic in. of the burned ware net; 3, ability of the ware to resist heat; 4, character of the body; 5, building code.

1, Building Code, 2, weight per cubic in. of the burned

ware net; 3, ability of the ware to resist heat; 4, character of the body.

The answer to above questions involves a statement as to what is the best, the most efficient, type of hollow tile fire-proofing to use. As this is a much-mooted question it will be dealt with under

Characteristics of the Burned Ware

It will be seen how necessary it is to consider what sort of body is to be ultimately obtained as the addition of foreign anti-plastics mentioned, saw dust, straw, slack, etc., influences the clay mixture; the clay mixture influences the working properties and the working properties determine: 1, type of die to be used; 2, design and speed of machine used; 3, drying treatment; 4, burning treatment. Of the preparation of the clay not much can be definitely said as this will vary to a great extent in detail with locality. This much, however, can be said; whatever clay mixture is decided upon it must be kept homogeneous, particularly when making the larger sizes of ware. Only can liberties be taken in this respect with smaller sizes. Customary practice is followed in grinding the clays, pug mills, disintegrators, roll crushers being used as conditions demand. Tempering may be done in wet pans, pug mills, etc.

General Shop Practice

Hollow tile fireproofing may be made on: 1, sewer pipe presses; 2, horizontal steam plunger presses; 3, auger machines—either horizontal or vertical delivery.

This is quite a range of methods but I should say the majority of ware manufactured at present is made on horizontal auger machines.

A discussion of types of machines is to no purpose as no one machine can be expected to adapt itself to all clay conditions, and adjustments must be made to meet the demand of the locality.

Adjustments must be made to sewer pipe presses and horizontal steam plunger presses to produce the maximum amount of ware with the least expenditure of power. Proper ratios of diameters and lengths of steam cylinders to clay cylinders must be determined. Size of intake and exhaust ports on steam valve determine speed of press which in turn is determined by character of clay being worked. On auger machines the type of auger and propeller, the shape of the nozzle and then the kind of nozzle liners all depend on the character of the clay being worked, fineness of grain, plasticity, etc., although the straight barrel or nozzle machine is being used to-day more than any other type. The call of the auger machine is to produce the greatest amount of ware with the minimum wear and tear on the machine and the minimum consumption of power. Hollow tile imposes a greater load on a machine than brick, due to the cores obstructing the free issue.

Hollow tile fireproofing may be loaded on dryer cars, sewer pipe trucks, or any of the methods in vogue.

Hollow Ware Dies

The study of hollow ware dies presents the greatest field for investigation in the industry, on which much valuable information remains to be collected, and of which volumes might be written. The investment in dies in the well equipped hollow tile fireproofing factory is tremendous. Not only must the patterns, castings, machine work, be considered in determining the final cost of the die but also the labor utilized in adjusting it. Dies may be of cast iron, cast steel with

bridges, of the same material or of machine steel. They may be high bridge long stem, or low bridge short stem. They may be thick bridged or thin bridged. They may be made with a short boss or a long boss, lined or unlined, lubricated or non-lubricated. The character of the clay and the shape of the piece to be manufactured determine the kind of die from which best results may be obtained in each locality. The friction on ware being forced from a die is essentially greatest on the shell of the piece while the pressure of the auger is greatest at the centre. The die must be either made or adjusted to equalize the rate of flow and the pressure at all points in the die. Drying and burning are the measures of correct die construction and adjustment.

Characteristics of the Burned Ware

The ware, having been burned and drawn from the kilns, in order to study its characteristics it will be well to consider these under the different types—dense, semi-porous and full porous. Dense body ware is as nearly vitrified as possible; of low absorption and in the great number of cases brittle. Of the three types of body this has the greatest conductivity. Hollow tile dense is usually of thin shells and thin webs. This type of ware furnishes the required strength with the least weight per cu. in. Its brittleness and high conductivity are its drawbacks. This type of ware is usually made from high-grade fire clays or clays that are capable of receiving severe burning treatment without presenting distortion of the piece.

Semi-porous ware has as a rule shells and webs of slightly increased thickness over dense ware. This increase accomplishes two purposes. 1. It admits of the introduction of non-plastics and still allows easy working of the mass. 2. It maintains the crushing strength per square inch. Foreign matter that burns out of clay bodies essentially leaves them weaker, and to preserve the strength of shell and web it is necessary to make them thicker. Semi-porous ware is less brittle than dense, and of lower conductivity. Its weight is slightly increased over that of dense ware, being of slightly greater absorption. It is easily laid, easily cut. The bulk of the fireproofing manufactured to-day is of the semi-porous type.

Full porous ware is as a rule from 5 per cent. to 12 per cent, heavier per piece than semi-porous. To maintain the strength of the piece the shells and webs are much thicker than semi-porous. Its conductivity is the least of any of the three types. It is a tough, sturdy type of ware with the greatest absorption of any of the three and superimposes a 5 per cent. to 12 per cent., average 7 per cent. greater wall or floor load per square foot than semi-porous. There is less of this type manufactured on this continent than either of the other two.

The physical relation of porosity and absorption in clay wares has been gone into rather thoroughly, and as determination of percentage of absorption is the first step in a porosity test it will be well to consider absorption and what it primarily determines, as porosity is a secondary determination.

The widely used absorption test consists in soaking the piece in water, weighing before and after, the gain in weight being calculated in the percentage of the dry weight. It has been shown by experiment that a piece of burned clay, after having been soaked six months will still be gaining slightly in weight, but that 90 per cent. of the final total will have been accomplished in forty-eight hours; and this length of time was once adopted by the N. B. M. A. as standard.

The length of soaking period and absorption depends on 1, pressure; 2, size of piece; 3, porosity. A given piece will have a greater gain if soaked in a receptacle under a vacuum pump than if soaked at atmospheric pressure, as the absence

of air in the pores under the pump allows water to completely fill them.

Actual absorption is only used in determining or comparing failure as to strength and weather resisting qualities, and is primarily used to express quality, and secondarily is translated in terms of porosity.

Porosity is the volume of pore space between particles of clay, expressed in percentages of total volume of piece, and depends on the size and shape of the particles making up the mass.

$$\text{Por} = \frac{W-D}{W-S} 100$$

W = wet weight.

D = dry weight

S = suspended weight.

W-S = Volume

$$\text{Por} = \frac{L}{V} 100$$

L = wt. water absorbed (gain in wt.)

V = volume of test piece.

From specific gravity

$$\text{Por} = \frac{\text{Real}-\text{App.}}{\text{Real}} 100$$

This specific gravity may be determined by grinding piece to fine powder.

These formulae and standards must come from the laboratory and hardly fall within the work of the factory operator, yet a knowledge of them is a help. It is consequently seen that because a piece of fireproofing absorbs 10 per cent. of its weight of water it is not 10 per cent. porous.

Were it possible absolutely to vitrify to non-absorption the clay walls surrounding void spaces, then porous ware would resemble coral and not a sponge. But we have accepted vitrified ware with absorptions as great as 5 per cent. and 8 per cent., consequently moisture will continue to pass through the thin walls into the closed pores of the piece. Clay ware overburned to a vesicular, scoriaceous mass approaches nearest to the coral theory.

A word in conclusion as to the best type of fireproofing—dense, semi-porous or full porous. All will withstand as great or greater heats than the supporting steel; that is the major requirement. Consequently increased porosity would not seem to be a measure of better fireproofing.

I would now respectfully suggest that a committee be appointed to go into the subjects of:—standards applied to size of brick; crushing strength of brick walls; crushing strength of hollow tile, sewer pipe, etc., so that questions involving relative merit of clay products may be definitely and intelligently answered.

The city council of Regina, Sask., has approved the expenditure of \$140,000 on sewerage extensions; \$450,000 on pavement work, and \$295,000 on street railway extensions.

According to a report from Saskatoon, Sask., an interview with leading local architects is productive of the information that most of them are engaged on plans of important buildings contemplated for spring commencement, but concerning which they are as yet somewhat reticent. They would at least admit however that prospects were quite satisfactory—indeed much more so than might have been expected or was generally realized. It is admitted further that some very important building developments involving Old Country capital will be announced shortly. The building supply business is also looking up, and enquiries are coming in most encouragingly. Building contractors anticipate a good year.

Progress at Vancouver and the Coast

Excellent Records on Larger Undertakings — The Hudson's Bay Company's Addition, Hotel Vancouver and Other Big Building Work

Correspondence of the Contract Record

Vancouver, Feb. 12th, 1914.

NOTWITHSTANDING the extremely unfavorable state of the weather at the Coast during the last few weeks noteworthy progress has been apparent on practically all of the large buildings under construction, in various parts of the city. Chief among the contracts on which activity has been most pronounced are the new C. P. R. Hotel Vancouver and the six-storey addition for the Hudson's Bay Company, two immense projects possessing many outstanding features of constructional interest. In the case of the Hotel Vancouver, the steel frame work in the 11-storey portion of the Granville street wing adjoining Georgia street has been completed and the foundations for the remainder of this wing are in place and work well under way on the lower storeys. The central and main section of the building is gradually assuming a finished appearance with the exterior facing of brick and terra cotta practically in position to the full height of 16-storeys. The contractors have estimated that over 4,000 tons of steel will be used altogether in this contract. In the main entrance vestibule on Georgia street marble, mosaic and terrazzo tile will be used for the floor and ornamental plaster for the ceiling. The vestibule will contain 20 pillars, each of which is to be panelled in marble to a height of 4 feet and above that in Austrian oak. A similar style of wainscoting will be used for the entire ground floor. The building will contain 700 bedrooms altogether, each room having access to a private bathroom. All bedrooms will be fitted with solid oak doors and the interiors will be finished in white enamel. A convention hall measuring 50 x 100 feet will be one of the features of the Granville street wing. Provision has been made for a billiard room of similar dimensions directly underneath the convention hall in the basement. The hotel will have four main entrances altogether, one of these being in the Granville street wing and leading directly to the convention hall. A roof garden with pergola measuring 60 x 200 feet will comprise the entire 16th storey of the central building. There will be 18 electrically operated elevators in the hotel. In order to ensure the completion of the work by January, 1915, it is necessary to have over 400 men constantly employed. The cost of the entire contract is expected to run as high as \$2,500,000. Mr. Francis S. Swales, architect for the C. P. R., prepared the plans, and Messrs. Skene & Christie, Vancouver, are carrying on the work of construction.

Hudson's Bay Addition

Rapid constructional progress is in almost daily evidence at the corner of Georgia and Seymour streets, Vancouver, where Messrs. Rourke, McDonald & Moncrieff are erecting a massive reinforced concrete store addition for the Hudson's Bay Company. A start was made with the terra cotta facing at the end of January, and the efforts of the contractors are being directed towards completing this part of the work with every possible despatch. The building occupies a site measuring 146 x 175 feet, and with the foundations constructed about 50 feet below the surface and strong enough to support five additional storeys, this is unquestionably the most substantial example of reinforced concrete work in the city. There are 59 concrete vertical supporting columns altogether, each embedded in a concrete foundation which measures 8 feet square at the sub-basement floor. The columns themselves are 4 feet square and taper at the rate

of two inches to each floor. The space below grade is occupied by the engine room, sub-basement and basement floors. Steel and concrete with terra cotta facing are being employed in the addition which forms only one-half of the entire contract, plans having been prepared for a duplicate building which will have frontage on Georgia and Granville streets. The street elevations of both structures will be decorated with rows of Corinthian columns. Messrs. Burke, Horwood & White, of Toronto, are the architects for the work, which, when fully completed, will represent an outlay exceeding \$2,000,000.

Messrs. Snider & Brethour are making good progress with a five-storey building which they are erecting on Beatty street, near Robson street, Vancouver, for Cope & Son, electrical contractors. Reinforced concrete and brick will be



Hudson's Bay Company's new store addition at the corner of Georgia and Seymour Streets, Vancouver.

employed in this structure, which measures 60 x 140 feet, and will cost approximately \$70,000. The building will have a granite base with stucco finish for the upper portion, tar and gravel roof and galvanized iron cornice. The mechanical equipment will include two freight elevators, and a complete system of hot water heating.

An immediate start is planned in connection with the construction of the new immigration building in Vancouver for which the contract was recently awarded by the Dominion Department of Public Works to Messrs. Snider & Brethour, a local firm of contractors. The building is to be erected on a site measuring 211 x 61 feet opposite the C. P. R. docks, and will be of steel construction, with brick walls and concrete floors. Concrete piles will be driven in order to support the foundations of the structure which will abut over the water. The figure of the successful tenderers was \$277,449, this amount being the lowest of a large number of bids submitted.

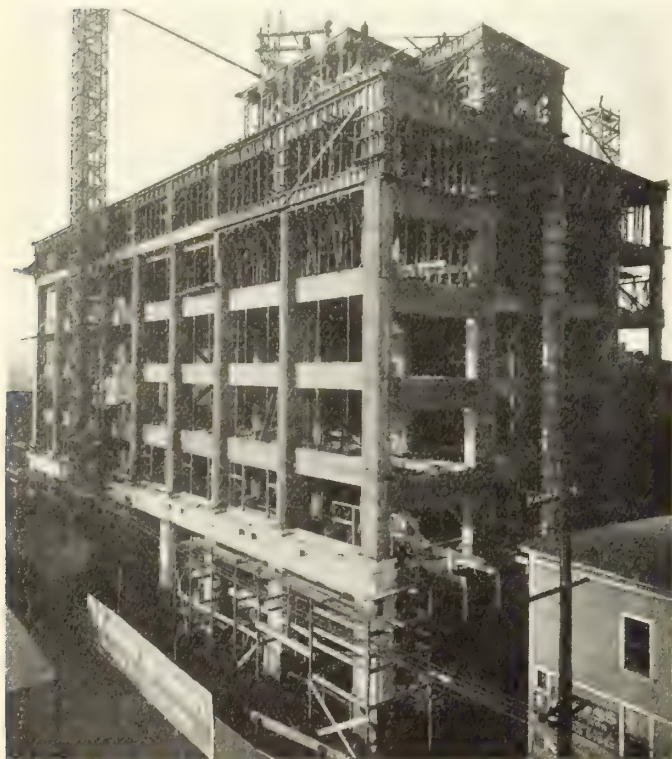
Excavating operations are proceeding on the site of the Vancouver-Prince Rupert Meat Company's new reinforced

concrete warehouse on Water street, Vancouver, and preparations are being made by Mr. E. J. Ryan, who has the general contract, for constructing the foundations of the structure. It is expected that the work will involve an outlay of at least \$40,000. Detail plans of the building were prepared by the company's draughting department.

Construction work will probably be started this spring on a six-storey warehouse which the McClary Manufacturing Company is planning to erect on a site measuring 120 x 125 feet at the corner of Smythe and Homer streets, Vancouver. It is believed that a structure of the reinforced concrete type will be decided upon, with trackage facilities and loading platform at the rear.

Work is about to commence on the proposed new factory building for the Restmore Manufacturing Company, which is to be erected on Venables street at the head of False Creek, Vancouver. The building is to be of brick and mill construction costing approximately \$147,000. Mr. A. Moir has charge of the general contract.

It is reported in Vancouver that the Imperial Oil Com-



Another view of the Hudson's Bay Company's addition at Vancouver.

pany is contemplating the immediate erection of a large warehouse and office building at Prince Rupert, which is to be utilized as the company's supply depot for the Northern B. C. trade. The estimated cost of the building together with five oil tanks, is placed at approximately \$200,000. The site selected is on Hay's Creek Bay.

Plans are in course of preparation by the construction department of the Vancouver School Board for an 8-room reinforced concrete school building to be erected on the corner of 20th avenue and Clinton street, at a cost of \$50,000. In addition to this building the school board will ask the city council for funds for an 8-room reinforced concrete building on Pender street, to cost about \$50,000; a 12-room reinforced concrete building to be erected, most likely on the Strathcona school site, to cost about \$75,000, and for a reinforced concrete gymnasium building to be erected adjoining the King Edward High School, the cost of which is to be about

\$50,000. Under the heading of repairs and improvements the board asks for \$80,000, including \$15,000 for changes to the school heating plants. The list of new work will also include funds to improve the grounds at the King Edward and Britannia high schools.

Recent amendments to the Victoria building by-law provide for an increase in the height limit of reinforced concrete structures to 130 feet, this being also the limit allowed for steel frame buildings erected in that city. For any other type of structure the limit in height is retained at 80 feet, but further restrictions are made to the effect that no building shall exceed in height the following times its least dimensions at the base; for buildings with skeleton frames, four times; for buildings with masonry walls, three times; for frame buildings, one and one-half times. These restrictions also apply to wings for existing structures. The height of all wooden or frame buildings to be used for human habitation will in future be limited to 40 feet, thus permitting only three storeys in structures of this type. Another important amendment and one which had become imperative, was that of raising the area for a building containing a single room. The old by-law restricted the area to 7,000 feet, but this has been materially increased, and will apply to department stores, churches, theatres, drill halls, skating rinks, public halls, places of public assembly and sawmills.

Tenders closed at Ottawa on February 16th for a new addition to the Victoria Post Office on which the sum of \$150,000 is to be expended by the Dominion government. On the rear section of the present structure are to be added two storeys. This will bring the entire block to a uniform level in respect to height, making a large, evenly proportioned building, with expensive frontages on Government, Courtenay and Wharf streets. The proposed alteration is expected to give enough additional space to provide for present requirements, as well as those of several years to come. The entire ground floor, from Government to Wharf streets, is to be given over to the post office proper. The second floor will be used by the customs department and is to be laid out with every convenience and in thoroughly modern fashion. The floor above is to be occupied by offices which will be used as extensions for the various departments in urgent need of larger quarters. The contract for the proposed addition will be awarded without delay, and it is planned to have the work carried out as expeditiously as possible.

Plans are in course of preparation for a new hotel building to be erected at Port Alberni, on the west coast of Vancouver Island. According to the meagre details available, the structure will be of brick and mill construction, three storeys in height, and will contain 70 bedrooms. It is understood that Vancouver capitalists are behind the enterprise.

Messrs. Knott & Jones, a Victoria contracting firm, have been awarded the general contract for the Dominion Government public building at Port Alberni, the cost of which will be about \$30,000. This building will have a heavy concrete foundation with brick for the exterior facing, and stone trimmings.

Application was made to the provincial government recently by an English syndicate for the lease of several small islands in the North Arm of the Fraser River, on which it is proposed to establish a shipbuilding plant and yards. Preliminary plans in connection with the project are being prepared by Mr. N. A. Leech, Vancouver, and it has been announced that an expenditure of \$100,000 is contemplated in the near future.

According to a recent announcement work will commence shortly on a brick manufacturing plant at Port Haney, Fraser Valley, B.C. Mr. W. J. Graham, who is a large property owner in the district, is behind the project, and states that a plant will be erected which will have a capacity of

500,000 bricks during the first year of its operation. No further details are available at the present time.

Municipal Developments at Saanich and Point Grey

The municipality of Saanich, adjoining the city of Victoria, is to be congratulated on its choice of Mr. David W. Johnson to fill the position of municipal engineer shortly to be vacated by Mr. C. H. Topp. Mr. Johnson has been chief engineer in the municipality of Point Grey for the last five years, and during this period has rendered noteworthy service in transforming the district from a rural suburb to its present standing as the most progressive municipality, from an engineering standpoint, on the mainland of the province. In his new sphere of activity he will be called upon to handle municipal development work of a nature similar in many respects to the undertakings which he has dealt with so successfully in Point Grey. Previous to his connection with the engineering department of Point Grey Mr. Johnson had been engaged in a civic office in the town of Ayr, Scotland. A recent report submitted to the Point Grey council by Mr. Johnson give the following summary of works carried out by his department during 1913:

Sewers, 12.16 miles; sewer connections, 4.3 miles; roads paved, 2.47 miles; roads macadamized, 6.14 miles; cement sewers, 0.42 miles; cement curbs and gutters, 0.38 miles; roads graded, 2.24 miles; roads cleared, 3.30 miles; lanes, 2.70 miles; roads planked, 1.47 miles; and wooden sidewalks laid, 17.19 miles.

The total expenditure on works carried out during the year amounted to \$608,726, being divided as follows: Roadways, \$141,734; sidewalks, wooden, \$17,241; lanes, \$7,852; sewers, \$421,109; local improvements, \$3,133; parks, \$1,953; box drains, \$682; gas plant buildings, \$1,133; and engineering, \$13,905.

With regard to the sewer works, the report states that it is worthy of mention that the rates per lineal foot for the various sewers laid last year, with the exception of the outfalls, were approximately 15 per cent. less than the rates for similar work carried out in 1912.

During the year, the report continues, plans showing 25 miles of street grades had been established, and plans showing 43 miles of proposed grades are now practically completed. The engineer remarked that this policy, besides anticipating the field data for future permanent road improvements, which when decided upon can be carried out immediately, eliminates the delay of building operations, and also admits of sewer and water main extensions and other underground works being installed permanently, thereby obviating the possibility of having to lift and relay these when permanent grades are established.

In a table with regard to general improvements it is shown that there are 125.31 miles of travelled roads in the municipality at the present time 61.10 miles of which are paved or macadamized. Lanes cleared are 41 miles; roads cleared are 51 miles; roads contour graded 33.9 miles; roads permanently grades, 30.31; roads macadamized, 45.04 miles; roads paved, 16.06 miles; cement sidewalks, 28.06 miles, of which 27 miles are in Shaughnessy Heights, wooden sidewalks, 74.35 miles; storm water drains, 10.55 miles, and sewers, 49.70 miles.

Road Congress for Montreal

Further particulars of the first Canadian and International Good Roads Congress, to be held in Montreal from May 18th to 23rd, are now available. The congress will be held under the auspices of the Canadian Highway Association and Canadian Automobile Federation, with the co-operation of the American Highway Association. The principal object is to inaugurate a co-operative educational campaign

which shall make for a uniform system of road building, proper methods, and economical management with a view to more practical work being accomplished. The promoters are of opinion that by an exchange of knowledge and experience by representative men much good can be accomplished. Amongst the proposed subjects to be discussed are matters relating to good roads legislation, the administration of public roads, the problems of construction and maintenance, the advancement of road building engineering in educational institutions, and other subjects of practical assistance to the good roads movement.

The various provincial governments have promised to send representatives, and invitations are also to be sent out to town engineers, county councils, boards of trade, engineering societies, and manufacturers' associations. A proposal will be put before the congress to organize an association with the object of developing the business interests of its members, and also with a view to giving assistance to municipal and other bodies desiring information as to road work. A feature of the congress will be an exhibition of various appliances used in the construction and maintenance of roads.

The official opening of the King Edward Highway, 45 miles in length, and connecting Montreal with the New York State roads, will take place during the week of the congress.

The Transportation Problem at Montreal

Mr. G. Janin, chief engineer, and Mr. McLeod, railway engineers of the City of Montreal, have submitted to the City Controllers a report on the transportation problems of the city. A short time ago the Montreal Tramways Company and the Canadian Autobus Company presented rival schemes for subways and autobuses, to the Council, and these were referred to the city engineering department. The report is a very exhaustive one, and points out that traffic conditions have now reached such a stage that the providing of additional car tracks, the changing of routes, and increasing the number of cars will only secure temporary relief for a few months or a year or two, when the city will again be confronted with the problem of improving the service. The report, therefore, includes a series of recommendations for the construction of underground rapid transit lines, to be operated in conjunction with surface cars, and the combination of these two to be supplemented by such motorbus service as may be deemed necessary; the widening of two or three streets to be used as business boulevards and afford new arteries both for local car traffic and the increasing volume of vehicular traffic.

Owing to the extension of the city and suburbs, the rate of travel since 1899 has increased 310 per cent, or more than twice the rate of increase in population. The result is that there is an almost unbearable congestion of cars at the rush hours. The engineers discuss in detail various routes for subways, and recommend a subway running east and west from Frontenac street to Atwater avenue, via Ontario, Burnside and Luke streets, a distance of 3.45 miles, at an approximate cost of \$8,800,000, a subway from Burnside street to Viger Square, via Craig and Latour streets, Dominion Square, and Peel street, 1.63 miles, approximate cost \$4,800,000, to serve the down-town district; and a subway under St. Lawrence Boulevard, north and south, 3.45 miles, approximate cost \$7,000,000. The total mileage is 8.21, and the estimated cost \$20,000,000, exclusive of widening or extending streets and equipment and plant.

The engineers suggest that tunnels be constructed under the Lachine Canal, and also that considerable changes in the routing of the existing surface lines will be necessary, in addition to the construction of new surface lines especially in the outer wards of the city.

Personal Mention

Mr. E. H. Verner has been appointed engineer of the municipality of Port Coquitlam, B.C.

Mr. E. R. Bingham has been appointed City Surveyor of Port Arthur, succeeding Mr. A. L. Russell, who has resigned.

Mr. C. H. Topp, formerly City Engineer of Victoria, B.C., has been appointed Engineer of the Municipality of Esquimalt, B.C.

Mr. J. Anderson formerly City Engineer of Moose Jaw, has resigned his position as Superintendent of the Brandon Street Railway Company.

Mr. V. J. Elmont, A. M. Can. Soc. C. E., consulting engineer, Montreal, was among those who attended the recent convention of the American Concrete Institute and the Cement Show at Chicago.

Mr. H. T. Fisher, tunnel engineer of the Mount Royal Tunnel of the Canadian Northern, gave an illustrated lecture in Montreal on February 13, describing the methods of locating the line and of construction.

Mr. J. V. Nimmo delivered a lantern address on the construction of the C. N. R. lines between the Yellowhead Pass and Vancouver before the Vancouver Branch of the Canadian Society of Civil Engineers on February 3.

Mr. J. Mackenzie, Bridge Engineer of the South African Railway, has received from the Institution of Civil Engineers a Telford gold medal for his paper on "Strengthening of Wrought Iron Bridges on the Cape Government Railways."

Mr. E. Lepage, Sr., at one time a very prominent contractor, died in Montreal on February 13, aged 83. He built a portion of the Intercolonial Railway, and also many churches, colleges and public buildings. Mr. Lepage was a native of Rimouski, P.Q.

Mr. N. B. MacRostie, Assistant Engineer, Roadways Department, City of Ottawa, was a recent visitor at the office of the Contract Record. Mr. MacRostie has our congratulations upon passing the Final Examination of the Association of Ontario Land Surveyors.

Mr. A. J. McPherson has been appointed Chairman of the Government Finance Commission of Saskatchewan. He is succeeded in the chairmanship to the Highway Commission of that province by Mr. F. J. Robinson of Regina, formerly Deputy Minister of Public Works. Mr. McPherson is a graduate of the School of Practical Science, Toronto.

Dr. Horace L. Brittain, a native of New Brunswick, and a graduate of the University of New Brunswick, has been appointed Managing Director of the Toronto Bureau of Municipal Research, now being organized to carry out the suggestions and reforms contained in the Civic Survey Report, which is about to be issued in its complete form.

Dr. L. A. Herdt, of Montreal, Mr. O. Higman and Mr. A. B. Lambe, of Ottawa, and Prof. L. W. Gill, of Kingston, have been appointed honorary members of the International Committee which has been formed to organize an International Electrical Congress to be held in September, 1915, at San Francisco during the Panama-Pacific Exhibition.

Mr. Hunter McDonald is the new president of the American Society of Civil Engineers. Born in Virginia in 1860 and educated in Louisville, Ky., schools and Washington and Lee universities, Mr. McDonald entered the service of the Nashville, Chattanooga and St. Louis Railway as assistant engineer, in 1879, succeeding the late Col. R. C. Morris as chief engineer in 1892.

Mr. W. E. Woodhouse, who for the last four years has

been assistant superintendent of motive power of the western lines, is appointed superintendent of the same department for the eastern division of the Canadian Pacific Railway, with headquarters in Montreal. Mr. Woodhouse has been in the company's employ for 22 years, the greater portion of which has been spent in British Columbia and Winnipeg.

Mr. Geo. T. Clark, formerly city engineer of Saskatoon, has been appointed vice-president and construction manager of Western Pavers, Limited, Winnipeg. Mr. Chas. Curtis remains president and sales manager of this company, with Mr. Henry J. Keith, formerly of Toronto, secretary-treasurer. It is of interest to note that since 1910 Messrs. Western Pavers, Limited, have built over one million dollars' worth of walks and curbs in the prairie provinces.

Mr. Edward Hervey Lee, who has been elected president of the Western Society of Engineers for 1914, has been chief engineer of the Chicago & Western Indiana Railroad and of the Belt Railway, Chicago, since 1898. Beginning railroad work as rodman for the Scotia Valley Railroad in 1880. Mr. Lee has given his services to railway engineering for practically 30 years. He was born at Dayton, Ohio, in 1863 and educated at Ohio and Wooster universities.

Mr. John Coates, founder and chairman of the engineering firm of John Coates, Limited, London, Eng., died recently. He was born at Newcastle-on-Tyne in 1846, and obtained his early engineering training at the Elswick Works. Having gained some London experience he ultimately established the business with which his name has been so prominently identified for many years. He had a branch office at Ottawa where he resided for sixteen years, and was associated with the installation of many important public works throughout Canada. For some time he was president of the Ottawa Gas Company, and the Ottawa board of trade.

Canadian President of American Road Builders' Association

Mr. W. A. McLean, Chief Engineer of the Highways Department of Ontario, who was elected President of the American Road Builders' Association at a meeting of that body held last week at the Hotel Astor in New York, enjoys the dis-



Mr. W. A. McLean, Toronto, the new President of the American Road Builders' Association.

tingtion of being the first Canadian to occupy that important office. Mr. McLean is well-known to readers of this journal by virtue of many able contributions published herein and any extended mention of him would be superfluous. Most of us remember his succeeding "Good Roads" Campbell some

years ago and everybody appreciates his zealous devotion to the interest of highway improvement—devotion which has contributed greatly to the fame of Ontario as an enlightened state which puts transportation facilities in the front rank of the things that make for a country's progress. Mr. McLean is a man of widely diversified professional experience and has attended all the more important road gatherings in Canada and the United States during recent years. He came into additional prominence last summer at the Third International Road Congress in London, Eng., a noteworthy event (reported in detail for this journal by one of its editors) attended by the representatives of some forty nations and states.

An Important Appointment

Mr. W. Furniss Clarke, who has been appointed General Superintendent of the large new Armstrong-Whitworth Steel Works, Longueuil, on the south shore of the St. Lawrence, opposite Montreal, is an Englishman who has made good in



Mr. W. Furniss Clarke, General Superintendent, Armstrong, Whitworth Steel Works, Longueuil, Que.

Canada. He has been connected with George Anderson & Company, Limited, for a number of years, and by dint of earnest work and ability has raised what was a branch office to the dignity of a Canadian Company, of which he was made managing director, with full charge of the company's business in Canada. Mr. Clarke is very well known amongst cut stone contractors from the Atlantic to the Pacific, and is held in high esteem by those with whom he has had business connections.

On coming to Canada he started in an unimportant position with the Northern Electric Company eighteen years ago. He left that company after three years as chief draftsman, on being appointed, under the late David A. Murphy, as an assistant mechanical engineer with the Dominion Bridge Company, for whom he worked for several years.

Subsequently, Mr. Clarke was shop engineer of the Locomotive and Machine Company, Montreal, and of the Dominion Car and Foundry Company's Blue Bonnets Shops. Being at that time in very poor health, he decided to get out of the shops, and to take up the sales end with George Anderson & Company, the result being the building up of a large business for that company.

Instead of building stone cutting machines, Mr. Clarke will make the steel and tools, and is already enthusiastic as

to the qualities of Armstrong-Whitworth steel for some planer tools.

He is most emphatic in his views as regards his Canadian citizenship and belief in the great future that lies ahead of his adopted country.

Canadian Railroad Development

The Canadian Pacific Railway is building a pipe line from Port Coquitlam to Port Moody, B.C., and at the latter place are to construct a large storage oil tank and pumping station. The company will also erect a wharf to accommodate the oil ships.

The Canadian Northern Railway Company has appointed Mr. A. R. Mackenzie, C.E., to examine the plans of the sewerage commission for work at the head of False Creek, and to ascertain an equitable basis on which to assess the railway company for the Clark Drive sewer.

Returns presented to the Dominion Parliament on February 10 give details of the new scheme of railway terminals at Quebec. The estimated cost of the original plans was \$6,406,153, but the new scheme has brought the estimate down to \$5,847,250, and besides, several modifications appear in the constructional plans.

Dr. John Humphrey Evans, who died at Barry's Bay, Ont., on February 11, following a fit of apoplexy, had been intimately associated with the building of the Grand Trunk line from Toronto to Burk's Falls in 1885, having been attached to the medical staff of the railway during the construction. He was a graduate of Trinity College, Toronto, graduating in medicine in July, 1885.

The Temiskaming & Northern Ontario Railway Commission have planned an inspection of the road in the near future for the purpose of deciding on improvements to be carried out during the year. The extension of the railway from Elk Lake to Gowganda is a matter for the government to decide as the country is almost exclusively mining, and railroad construction in that region will be difficult. About \$50,000 has been expended in surveys as far as Sudbury, which will be the terminus of the branch. This will give connection with the Canadian Pacific and the Canadian Northern Railways.

An announcement is made that Mr. E. J. Mackenzie, son of Sir William Mackenzie, who returned to Winnipeg recently after an absence of two years in California, will assume active control of the Canadian Northern lines west of Lake Superior to the Pacific Coast, in the capacity of second vice-president. Mr. Mackenzie will be in complete control of the Transcontinental lines to be opened this summer. It is understood that Mr. A. E. Warren, present assistant general manager in Winnipeg will move to the Pacific Coast to take up the management of the Canadian Northern mountain division, and the office vacated by him will be filled by Mr. J. S. Cameron, general superintendent, Winnipeg.

The Toronto Branch of the Canadian Society of Civil Engineers inaugurated a series of monthly luncheons on February 11. The function was presided over by Mr. C. H. Mitchell in the absence of the Chairman of the Branch, Mr. A. F. Stewart. The speakers included Dr. Galbraith, Mr. C. R. Young and Mr. J. M. Clark, K.C.

Messrs. Wilson, Townsend & Saunders, engineers and contractors, whose headquarters are at Moose Jaw, Sask., have opened a branch office at 79 Spadina Avenue, Toronto. They have secured from the city of Toronto a contract for the construction of an underground sewage pumping station on Scott street, and they are looking forward to an active season in the east.



President—Mr. J. L. Skene, of Messrs. Skene & Christie, contractors.



Second Vice-President—Mr. T. J. Madlen, Manager Dominion Construction Company.



First Vice-President—Mr. W. M. Horie, of Messrs. Baynes & Horie, contractors.

NEWLY-ELECTED OFFICERS OF THE VANCOUVER BUILDERS' EXCHANGE

Vancouver Builders' Exchange an Active Body

GRATIFYING evidences of the success which has attended the organization of the building interests of Vancouver were forthcoming at the annual banquet of the Vancouver Builders' Exchange, reported briefly in our last issue. In our previous article we gave an outline of the addresses, together with a list of the new officers. We now have pleasure in presenting to our readers Messrs. Skene, Horie and Madlen, president, first vice-president and second vice-president respectively, and in giving supplementary particulars concerning the work and aims of the association.

Acting on instructions from the general contractors' section, the Secretary, Mr. W. Hamilton-Lindsay, has taken up with the Ministers of Public Works at both Ottawa and Victoria the question of having all plans for public work in British Columbia sent to the Exchange, with the result that the Minister at Ottawa has given instructions to that effect, though the Minister at Victoria states that they cannot depart from their regular custom of sending them only to Government offices.

The question of a uniform contract for general contractors, and also for sub-contractors has been the subject of several meetings between a committee of the Vancouver Branch of the B. C. Society of Architects and a committee from the general contractors' section, and between the general contractors' committee and committee from the sub-contractors, and is still under consideration. Some of the work which it is hoped the exchange will undertake at an early date has been mapped out as follows:

Employers' Liability Insurance: classified vs. flat rates.
A standard form of measurement.

Joint conferences between representatives of the organization and the city authorities with a view to securing a revision of the building by-laws.

The question of examining and licensing building inspectors, superintendents of buildings and clerks of works.

The Secretary's report also dealt with a number of innovations which it is proposed to establish at an early date,

among these being a daily change hour for trading and business purposes generally, to keep constant watch over legislation and all other matters affecting the building industry in the interests of the members, to secure plans for public and other works upon which the members will be given an opportunity to submit tenders, to have a permanent exhibit of building supplies, to obtain the services of a competent lawyer, and to display daily bulletins of building information.

The Treasurer's report which followed indicated the excellent financial standing of the exchange, there being practically no liability.

Competitive plans have been received for the new Masonic Temple to be erected on the west side of Spadina Road, north of Bloor Street, Toronto. The first prize of \$1,000 for the best plan is awarded to Mr. H. P. Knowles. A native of Hamilton, Ont., Mr. Knowles has been practising his profession as architect in New York for some years. Mr. John M. Lyle, the well-known Toronto architect, secured second prize, the third and fourth prizes being won by Messrs. Hutchison, Wood & Miller, of Montreal, and Messrs. A. W. Gould and A. E. Harvey, of Victoria, B.C., respectively. The building will cost about \$300,000 and tenders will be called at an early date.

The profits of the Nova Scotia Steel and Iron Company for last year were \$1,255,953, the largest in the history of the company, and an increase of \$255,344 over 1912. After meeting all charges, writing off and appropriating sums to depreciation, reserve, etc., and paying a dividend of 6 per cent. on the common stock, \$75,286 is carried forward. Mr. T. Cantley, the general manager, states that the demand for the company's products during the early months of the year were good. During this period a large tonnage was booked at fair prices sufficient to keep the mills fully employed until the closing weeks of the year, the result being that the outputs of iron ore, pig iron, steel ignots, billets, bars and forgings all showed substantial increases over previous years.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

At a cost of \$150,000 the city of London, Ont., is to have a system of storm water sewers, and tenders for the work will be called in March.

Tenders are to be called for the building of a new \$400,000 college in Montreal. The architects are Messrs. Peden & McLaren, Montreal.

Plans for a new horticultural building for the Central Canada Exhibition Association, at an estimated cost of \$48,000, have been prepared by Mr. Allan Keefer.

The government has decided to grant in instalments a loan of fifteen million dollars to the Montreal Harbor Board, and two million dollars for this year's harbor works at Quebec.

The city of Toronto contemplates laying a new supply main in the north end of the city, at a cost of \$525,000, also an extension of the high-pressure fire zone to involve an outlay of \$500,000.

The Canadian Stewart Company has been given the contract for the new development works at Toronto Harbour, the contract price being \$5,371,372. Between the highest and the lowest tenders there was a difference of \$2,000,000.

The New Brunswick Wire Fence Company anticipate a good year's business judging by the number of orders at present on hand. The factory is equipped with up-to-date machinery for the production of woven wire fence and staples.

Messrs. J. A. Eaton & Son intend erecting a new factory at Orillia this year at a cost of \$400,000. The plans have already been prepared and all that remains to be done is to receive the sanction of the ratepayers to a loan and a suitable site.

The city engineer of Maissonneuve, P.Q., has been instructed to prepare plans and estimates of a municipal housing system. The Mayor stated there was a shortage of 3,000 flats—a condition which will be accentuated when the Vickers, Limited, shipbuilding yard is completed.

Much satisfaction is felt in Fredericton, N.B., at the announcement of Hon. H. F. McLeod, M.P., that the St. John Valley Railway Machine Shops are to be located in that centre. The Federal Department of Public Works is also arranging for two new concrete wharfs to be built on the water-front in Fredericton.

Estimates for Toronto public works include \$351,000 for the Sherbourne street bridge; \$310,000 for the new bridge over the north ravine, Glen road; \$335,000 for the Moore Park bridge connecting eastern and western sections of St. Clair Avenue. New tenders have been called for the new Gerrard street bridge at an estimated cost of \$382,000.

Two 24-ft. hydraulic dredges with hulls 17 ft. long, 42 ft. wide and 12 ft. deep, to cost \$500,000, have been ordered for the work of deepening the Toronto harbour. Each will have a capacity of 18,000 cubic yards per day. The contract for the two dredge hulls has been placed by the Canadian Stewart Company with the Polson Iron Works and Shipbuilding Company.

The Toronto Eastern Railway directors are to be con-

sulted as to the possibility of the electric roads joining in the construction of a high-level bridge to cost \$150,000, which would provide a level roadway across the West Don, Toronto to the centre of the city. An interim report has been laid before the township council of York by Mr. Frank Barber, township engineer.

The Ford Motor Company are about to erect a reinforced concrete building at the corner of Dupont and Christie streets, Toronto. The structure will be of five-storeys with basement, the front of the first storey to be used as a show-room and for offices, the front of the second storey being reserved for a stock room. The new building will be ready for occupation early next fall.

Plans have been prepared for the building of the new Knox Church at Stratford, which promises to be one of the most stately edifices in Western Ontario. The building will be of red brick with cement footings, and will have a tower, 24 ft. square, standing 84 feet from the ground. Tenders for the work are to be sent to the architects, Messrs. Lindsay & Brydon, Toronto, by February 27.

The Hepworth Silica Pressed Brick Company, at a meeting in Owen Sound, decided to purchase the machinery for their new plant and to complete the necessary buildings and equipment as soon as weather conditions permit. The new plant promises to be one of the most modern and complete in the province, having a twenty-four hour capacity of 88,000 bricks. The plant will be located near Hepworth.

The Chatham Builders' Exchange held their annual banquet on February 13 under most successful auspices. The question of appointing a building inspector for the city was under discussion and hearty agreement was expressed with the proposal. Mr. A. J. Dunn, ex-mayor, stated that last year Chatham had had one of the greatest building years in its history, and Mr. John McCorbia, mayor of the city, expressed the hope that 1914 would prove a banner one in the history of the Builders' Exchange.

The building programme for Montreal this year promises to surpass that of any previous year. Excavation is expected shortly to begin for the station and terminal buildings of the Canadian Northern Railway at the city end of the Mount Royal tunnel, and the erection of a temporary depot for passengers. Residential construction will be carried out on an extensive scale, and new factory buildings and extensions, public schools, fire and police stations are also included in the building programme outlined for 1914.

St. John, N.B., is entering upon a particularly heavy season of construction work. Details of the operations now in progress have been given in recent issues of this journal, but in considering these it is well to remember that there are the additional items included in the estimates brought down at Ottawa. These comprise: harbour and improvements, \$3,000,000; new post office, \$325,000; spur lines to Courtenay Bay, \$134,000; extension of breakwater, \$100,000; Partridge Island wharf, \$50,000; quarantine station, \$45,000, and other items, \$66,000.

Discussing the possibilities of the different Canadian Provinces, experts of the Mines Branch, Department of Mines, Ottawa (who compiled a report recently declaring

that Canada possesses gas and oil fields of considerable value which, if developed, may rival those of the United States) say that in Alberta deposits are considerable, but cost of drilling is high. The province of Quebec gives no indication at the present time of developing fields of either petroleum or natural gas. New Brunswick oil fields, however, show considerable promise, and of Ontario the statement is made that the production both of petroleum and natural gas is on the decline and the total depletion of the underground supply is approaching.

From a report issued recently by the Department of Mines, Ottawa, we learn that the production of clay products, lime, cement, stone and similar construction materials in Canada during 1912, reached a total value of \$28,794,869, which represents an increase of \$6,850,258 or 26.8 per cent. over 1911, in which year the production was valued at \$22,709,612. The total production in 1910 was valued at \$19,627,592, and in 1910 at \$16,553,349. A satisfactory feature of the statistics for the past year is the fact that the Canadian consumption of products of this class is apparently increasing at a more rapid rate than production, which goes to show that construction materials are much in demand, and that the field of production is not by any means overcrowded.

About 150 members of the Engineers' Department of the C. P. R. attended the third annual banquet held at the Place Viger Hotel, Montreal, on February 14. Mr. H. Irvin, consulting right-of-way and lease agent, presided, and engineers from all parts of the system were present. The chairman referred to the immense growth of the C. P. R. and the engineering difficulties which had been surmounted. There were, he said, still great things to be done, and he was convinced that the difficulties which they presented would also be overcome. Mr. P. Motley referred to the building and double-tracking of the St. Lawrence bridge, and incidentally mentioned that the company had made an outlay of \$75,000,000 on the east and west lines in the course of one year.

WESTERN CANADA

A new post office is to be erected at Calgary, Alta., at a cost of \$250,000.

Medicine Hat, Alta., is to have new sidewalks at a cost of \$115,000, of which \$80,000 will be expended on concrete and \$35,000 on curb and gutter.

Tenders have been called for a new water system at Canora, Sask. The source of supply is Crystal Lake, a distance of 14½ miles. The outlay will be about \$200,000.

Edmonton public works this year include the laying of pavement involving an expenditure of \$900,000; \$227,000 on concrete walks, and \$156,173 on the telephone system.

Regina, Sask., has decided on a waterworks system which will mean an outlay of about \$290,000. The work is in charge of Mr. J. M. Mackay, Superintendent, waterworks department.

A movement is on foot to have the Saskatchewan government, Regina city council, Regina board of trade, Moose Jaw city council, and Moose Jaw board of trade co-operate with a view to improving the highway between these two cities.

A movement for the construction of better roads is at present engaging the attention of the Calgary board of trade. Recently a committee of this board waited upon the Hon. Charles Stuart, Minister of Public Works for the Province, to ascertain the government's intentions in this respect.

Mr. C. A. Dunning, member of the Saskatchewan commission which recently toured Europe, investigating grain conditions, has now advocated the construction of an inland waterway, permitting ocean-going vessels to travel to the

prairie. The cost of such an undertaking would be enormous, but Mr. Dunning claims it is essential to make grain production more profitable in Canada.

A 5,000,000-gallon water storage basin costing \$140,000 will be built within Regina's city limits during 1914. Supplemented by two new pumps which are to be purchased, this basin will insure 10,000,000 gallons for ordinary and an equal quantity for fire purposes.

The town of Athabaska Landing, to the north of Edmonton, has erected a number of important buildings following the destructive fire of a year ago. These structures include two hotels constructed along the most approved architectural lines, which indicates that the spirit of progress has taken possession of the inhabitants.

Experiments carried on by the Alberta Clay Products Company, Limited, Medicine Hat, are said now to have reached the stage when the right kind of clay mixture has been determined for the production of satisfactory sewer pipes. Many attempts have been made for some time to manufacture the highest grade of sewer pipe in the Canadian West, and apparently success has at last attended their efforts.

An innovation in civic construction work has been suggested by Mr. W. G. Douglas to Winnipeg Board of Control. His plan is to manufacture cement curbing for street paving at the city shops during the winter. The scheme is declared by experts to be quite feasible, and the controllers favor it on the ground that it would provide a good deal of work during the winter, to men who would otherwise be unemployed.

A scenic road is being constructed from Revelstoke, B.C., up Mount Revelstoke to Victoria Park on its summit. Commencing on the western boundary of the city, at an altitude of 1,450 ft., with the aid of five switchbacks, the road reaches the summit, 12.8 miles distant, at an altitude of 6,350 ft. On completion of the road the Canadian Pacific Railway contemplates an automobile service connecting its hotel at Revelstoke with the chalet at the summit, which is to be constructed by the company. The average grade of the road is 6.6 per cent., maximum 7.6 per cent. The park on the summit consists of a plateau of some 70,000 acres.

During 1913 the road construction of the Colonization Road Department reached a mileage of 1,300, entailing an expenditure of \$405,351. The northern district which embraces the Rainy River, Sudbury, and other northern districts, received 292 miles of colonization roads and 205 miles of by-law roads, the government bearing the total cost of the former, and of the expenditure of \$59,000 on the by-law roads the municipalities in the district contributed \$14,000. In the western district which takes in Parry Sound and surrounding territory, 110 miles of colonization roads were built and 80 miles of by-law roads. The figures for the rest of the province give a total length of 292 miles of colonization and 344 miles of by-law roads at an expenditure of \$52,000, of which the government's contribution was \$32,000.

With other estimates still to be dealt with, the Utilities and Works Committee of Regina City Council have authorized an expenditure of over \$2,000,000 for civic undertakings during 1914. The programme is not as large as last year, but in view of general conditions much work that would ordinarily be undertaken will have to stand for the present. That so much work is necessary, in view of the large programme carried out last year, indicates the development of the city during last year. Sewer and water works provide for a large proportion of expenditure, the works in this regard to cost over three-quarters of a million dollars. Street railway extensions have been cut down to a minimum, and only the sidewalk programme left over from last year will be constructed during 1914.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Canora, Sask.

Tenders addressed to H. M. Sutherland, Town Sec.-Treas., will be received until Feb. 28th, for the construction of a water system. Water is to be brought from Crystal Lake, a distance of 14½ miles.

Edmonton, Alta.

An agreement is being drawn up between the City and the Hudson Bay Co., whereby the latter is to pay cost of paving of Portage Ave. and the City to do the work. The total cost is estimated at \$750,000.

The sums of \$900,000 and \$227,000 have been approved by the city council for the construction of pavements and sidewalks.

The following items have been included in the city estimates, catch basins, \$17,000; storm sewers, \$20,000; sewage disposal plant, \$53,000.

London, Ont.

Prices per foot are required by the City Council for cement curbs and gutters to be laid during the year.

The city council propose laying pavement on Ridout St. from Horton St. to Garfield Ave.

Medicine Hat, Alta.

The city council has included the following items in the estimates. Concrete sidewalks, \$80,000; curb and gutter, \$35,000.

Nanaimo, B.C.

The Municipal Council is considering the re-grading of certain streets at an estimated cost of \$24,000.

The ratepayers will be asked to vote on a by-law authorizing the expenditure of \$50,000 on the construction of new water mains on ten streets.

Ottawa, Ont.

With reference to the question of the water supply system a plebiscite will be taken on March 9th. The proposed schemes are (1) The 31-mile Lake scheme; (2) from Ottawa River, sand filtered, above Britannia; (3) from McGregor lakes; (4) the Mechanical filtration of Ottawa River; (5) from Lake Dechenes without filtration.

The following asphalt paving of Bank St. is proposed by the city council; the approximate quantities are as specified. Between Wellington and Laurier Sts., 3,928 sq. yds.; stone setts, 2,876 sq. yds.; gutter, 2,576 lin. ft. Asphalt pavement with stone blocks in track allowance, between Laurier and Gladstone Sts., asphalt, 8,253 yds.; stone setts, 5,536 sq. yds. The total estimated cost is \$84,000. Archibald Currie, City Engineer.

Experimental farm roadways are to

be constructed this year with tarvia pavement by the Public Works Dept.

The sum of \$80,000 was allowed in the estimates for short watermain extensions.

The Waterworks Dept. is considering the installation of an electric pump and 500 gal. tank at Dundonald Park Well.

Peterboro, Ont.

Plans for a sewer disposal plant with trunk sewer to take care of the entire sewage system of the city are to be submitted to the Prov. Board of Health, and if approved of, tenders will be called for. The estimated cost of the project is \$100,000.

Port Arthur, Ont.

The expenditure of \$800,000 on the construction of a sewage disposal plant is being considered by the city council.

Regina, Sask.

The ratepayers will vote on a by-law shortly providing \$20,000 for the construction of No. 6 filter bed.

Plans are in progress for the laying of about 230,000 square yards of pavement this year.

The following work has been decided upon by the Waterworks Dept. at the estimated cost specified, 20 supply wells, \$4,000; air lift pump, compressor and air line, \$20,000; temporary sterilizing plant, \$1,000; pumping unit for city power house, \$35,000; pumping unit for Boggy Creek, \$5,500; meters, \$35,000; collecting pipe lines, \$50,000; and basin and pipe line to the power house, \$140,000.

Considerable work is contemplated by the city council, and the following amounts have been approved. Filter bed, \$25,000; sewers, \$140,000; pavements, \$450,000. Engineer, F. McArthur.

Sombra Twp., Ont.

A large number of tile drains are to be constructed by the township council. Clerk, W. A. Scott, Wilkesport, Ont.

Toronto, Ont.

The sum of \$5,000 was included in the estimates for improvements at North Toronto Waterworks Park.

The sum of \$6,000 has been included in the estimates for a 7 ft. fence around the reservoir.

The York Twp. Council is considering the construction of a sewage farm, which, if feasible, will obviate the necessity of making sewerage connection with the city service.

The sum of \$5,000 was included in the estimates for grading the new Athletic Field at Centre Island.

Vernon, B.C.

The municipal council is considering extensions to the waterworks.

Winnipeg, Man.

The construction of a sewer on Erin

St., at a cost of \$7,396, is being considered by the Board of Control.

CONTRACTS AWARDED

Port Arthur, Ont.

A contract for the laying of 37,000 sq. yds. of macadam roadway has been awarded by the city council to Hugh Wroy.

Railroads, Bridges and Wharves

Brantford, Ont.

The Grand Valley Rly. Co. has accepted the offer made by the city of \$253,000 for 7 miles railway in the city and 22 miles from Galt to Brantford. This amount includes \$125,000 owing to the National Trust Co. bonds and the liabilities of the company to the city. This is subject to confirmation by the courts and the ratepayers.

Breslau, Ont.

The Waterloo Twp. authorities are considering the construction of a steel superstructure bridge, of one 60 ft. span.

Dundee Twp., Que.

Tenders will be received by T. W. Fraser, Sec.-Treas., until 10 a.m. March 2nd, for the construction of one 12 ft. span bridge on the Murchinson side-road; one 10 ft. and three 12 ft. span bridges on the 2nd concession road with concrete covering. Plans and specifications are at the office of the council.

Fort George, B.C.

A site for the erection of the G. T. P. Railway station has been decided on. Supt., G. A. McNicholl, Prince Rupert, B.C.

London, Ont.

The C. P. R. Co. proposes to rebuild the Oxford St. bridge.

North Regina, Sask.

The Grand Trunk Pacific Rly. Co. will probably erect a new depot at an estimated cost of \$20,000. Resident Engineer, J. W. De Stein, 2123 Retallack St.

Osgoode Twp., Ont.

Tenders will be received by the Town Clerk until March 2nd, for a concrete construction arch bridge.

Owen Sound, Ont.

The Public Works Dept. has under consideration the construction of a new east side dock, about 600 ft. long, estimated cost \$50,000.

Philipsburg, Que.

Specifications are at the office of sec.-treas., A. H. Borden, who will receive tenders until 6 p.m., February 27th, for the construction of a retaining wall and the raising and gravelling of the road on the Lake Shore.

Peterboro Co., Ont.

The county council has approved the rebuilding of the following bridges: Canal Bridge, Drummond Twp.; David-

son's bridge, Asphodel Twp.; Doxie's bridge.

Toronto, Ont.

The Board of Control will receive tenders until April 14th in connection with Gerrard St. bridge: (1) for steelwork, fabricated and erected complete; (2) for steelwork, fabricated and delivered f.o.b. cars at the bridge site; (3) for the unloading of the steelwork at the site and the erection of same. Specifications, etc., at the office of Railway & Bridges Section, Dept. of Works, City Hall.

The Polson Iron Works & Shipbuilding Co. has received the contract for the two dredges for work on Toronto Harbor improvements.

Toronto, Ont. Mt. Dennis

The G. T. R. are preparing plans for a freight siding, and it is expected that a freight shed and passenger station will be provided shortly.

Victoria, B.C.

Tenders endorsed "Tender for Marine Depot," and addressed to Alex. Johnston, Dept. of Marine & Fisheries, Ottawa, will be received until noon March 12th, for the construction of creosoted pile wharf at Songhees Reserve, with grading at new Marine Depot. Plans, specifications, etc., at the Dept., Ottawa, Agency of Dept., Victoria, and at the Post Offices, Vancouver and New Westminster.

Wellington, Ont.

Tenders will be received by R. C. Desrochers, Public Works Dept., Ottawa, until March 16th. Work to consist of dredging, construction of a wharf 300 ft. x 18 ft. pile foundation and timber superstructure; entrance pier 1,000 ft. x 20 ft. pile and timber construction, approximate materials, etc., piles, 73,000 lin. ft., walings, stringers, planking, etc., 307,900 ft. B.M., bolts, nails, etc., 103,025 lbs., dredging 100,000 cubic yards. Plans at office of J. G. Sing, Confed. Life Bldg., Toronto; Postmaster, Wellington, Ont., and at the office of the Dept., Ottawa.

Public Buildings, Churches, Schools, etc.

Brantford, Ont.

Tenders will be received by J. L. Barnes, Brantford, Sec. of the Elm Ave. Methodist Church, until Feb. 27th, for the erection of a Sunday school building. Architect, Geo. W. Hall, 321 Colborne St., Brantford.

The Zion Presbyterian Church Congregation propose reconstruction of the galleries of the church, increasing the seating accommodation.

Banff, Alta.

Tenders for the construction of a bathhouse will be received by Lyndwode Pereira, Secretary, Dept. of the Interior, Ottawa, until noon, March 16. Plans and specifications at the office of the Commissioner, Dominion Parks, Ottawa, Supt. Rocky Mountains Park, Banff, Chief Supt. Dominion Parks, Edmonton, Agent, Dominion Lands, Calgary, Agent, Dominion Lands, Winnipeg, Agent, Dominion Lands, Regina, Immigration Agent, Vancouver, B.C.

Calgary, Alta.

The following items were included in

the estimates of the Public Works Dept. Receivers Gen. office, \$50,000; forestry office, \$50,000; post office, \$250,000; customs examining warehouse, \$300,000; drill hall, \$100,000.

Chatham, Ont.

The Public General Hospital authorities propose making a three-storey addition in the new wing, containing accommodation for 20 patients and nurses' quarters with laundry in the basement.

The additions to the "Queen Mary" School being considered by the Board of Education, are as follows: 8-room addition, pressed brick construction, concrete foundation, shingle roofing, electric lighting, and steam heating.

Causapscal, Que.

Tenders for the erection of an academy for the School Commrs. will be received by the Sec.-Treas., Henri Lemaire, until March 7th.

Dartmouth, N.S.

The erection of three schools of 10, 6 and 4 rooms respectively is being considered by the Board of School Commrs., estimated cost \$30,000. Chairman, W. H. Stevens, Portland street.

Dublin, Ont.

McBride & Gilbert, Edge Block, London, architects, are drawing plans for a \$19,000 school building for the Separate School Board.

Eastview, Ont.

The Separate School Board is considering the purchase of a site for the erection of a \$25,000 school building. Chairman, Jos. Durocher.

Edmonton, Alta.

Plans and specifications for a church to cost \$100,000, are to be prepared immediately for the St. Joachims R. C. Church Congregation.

Fort William, Ont.

Plans and specifications for additions and alterations to the McKellar General Hospital are at office of the Architect, R. E. Mason, Victoria Block, who will receive bulk and separate tenders until 5 p.m., March 4th. The estimated cost is \$30,000.

Ethel, Ont.

Tenders for the erection of a white brick school to cost \$15,000, will be received by A. H. MacDonald, Sec., until Feb. 28th. Architect, W. E. Binning, Listowel.

Hamilton, Ont.

Stewart & Witton, architects, 7 Hughson St. S., are about to prepare plans for the new Southam Home which the city is erecting at a cost of \$50,000.

The time for receiving tenders on the Y. W. C. A. building has been extended to March 5th. Architects, Mills & Hutten, 804 Bank of Hamilton Bldg.

Tenders for the new church of St. Peter's congregation will be called shortly. Architects, McPhie, Kelly & Darling, Bank of Hamilton Building.

Hansford, N.S.

Plans, etc., for the erection of a school are with Edmund Hudson, Hansford, who will receive tenders up to and including March 15th.

Hespeler, Ont.

The by-law having been carried, com-

petitive plans for the new \$20,000 town hall are called, to be completed and delivered by March 18th. Full information from the Mayor, Wm. H. Kribs.

Kelowna, B.C.

It is understood that the work on the new post office will be started this year.

London, Ont.

Shattuch & Hussey, 19 S. La Salle St., Chicago, Ill., have been appointed architects for the alterations to the Y. M. C. A. building, cor. Burwell and Dundas Sts. Further information can be obtained from the Secretary or J. K. McDermid, 508 William St.

The erection of a new church to cost \$10,000, is contemplated by the Ridout St. Methodist Church. Pastor, Rev. A. E. Lloyd, 152 Ridout St.

Louisburg, N.S.

The town council has under consideration the erection of a new school building, estimated cost \$5,000.

Medicine Hat, Alta.

The sum of \$20,000 was included in the estimates for the erection of an immigration building.

Midland, Ont.

The town council has granted \$1,500 for the purchase of a site at the corner of Dominion Ave. and 1st St., for the erection of a public library.

Mille Roches, Ont.

Plans are being prepared for the erection of a \$12,000 school for School Sec. No. 4.

Mitchell, Ont.

The erection of a new public school is under consideration by the School Board, estimated cost \$25,000 to \$30,000. J. S. Russell, Stratford, architect.

Moncton, N.B.

The rebuilding of St. John's Presbyterian Church which was recently destroyed by fire is under consideration. Further information can be obtained from F. B. Lynch.

Montreal, Que.

Plans for a school on Ottawa St. for the Roman Catholic Commissioners have been drawn by Wm. E. Doran, architect, 189 Bleury St., and tenders will be invited.

The erection of an office building on Notre Dame St. W., is being considered by L. A. Content, 17 Place D'Armes Hill.

D. J. Crighton, Jacobs Bldg., St. Catherine, architect, will receive tenders until Feb. 27th, for alterations to Dr. Hertz Institute, at the corner of Milton and St. Urbain streets.

The erection of a \$9,000 school is proposed by the School Commsn., Greenfield Park, and the Sec., H. Jones, will receive tenders until Feb. 28th. Architects, Hutchison, Wood & Miller, Royal Ins. Bldg., Montreal.

Montreal, Que., St. Lambert

Viau & Venne, 76 St. Gabriel St., architects, will receive tenders until Feb. 26th for the erection of a college building for the R. C. School Commrs., estimated cost \$150,000.

Moose Jaw, Sask.

The sum of \$100,000 was included in

the estimates of the Public Works Dept. for a public building.

Niagara Falls, Ont.

A site has been donated on Wilmott Ave. for the erection of a home in connection with the Y. W. C. A. work.

Ottawa, Ont.

The Board of Control has decided to rebuild the Howick Hall in the Exhibition Grounds as soon as possible. The cost is estimated at \$20,000.

The opinion of the St. Luke's Anglican Church Congregation will be taken shortly with regard to altering and redecorating the present church building.

The question of a system of Cottage hospitals is to be reported upon by the Health Dept., 1 for scarlet fever, 1 for diphtheria, etc., using existing Isolation Hospital as a unit.

The sum of \$7,000 was included in the estimates for 3 branch libraries in Hintonburg, Lower Town and Ottawa South.

The recommendation of the building committee of the First Baptist Church that additions and alterations be made to the church has been accepted. The work consists of new concrete floor in basement, the west wall to be taken out and rebuilt to make room for new organ, redecorating audience room, the wood spire to be taken down and rebuilt, and a new steam heating system installed.

Plans for a Sunday school to cost \$14,000, have been drawn for the First Ave. Presbyterian Church Congregation, by Architect, J. Albert Ewart, 193 Sparks street.

Plans for a new horticultural hall, to cost \$50,000, are being drawn for the Central Canada Exhibition Assn., by Allan Keefer, architect, 229 Sparks St. The erection of an agricultural hall is also being considered.

Palmerston, Ont.

Tenders for the erection of a post office, customs house and armoury, will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until March 9. Plans, specifications, etc., at the office of the Dept., Ottawa, Postmaster, Palmerston, and Station "F," Toronto.

Peterboro, Ont.

A site for the erection of post office, customs house, etc., has been selected on the north-east corner of George and Sherbrooke Sts.

Ponoka, Alta.

An addition to the asylum to accommodate 100 patients is being considered by the Public Works Dept.

Regina, Sask.

The site and grants for the erection of the Presbyterian College have been secured. It is estimated that the project will cost \$1,000,000.

The erection of a college is being considered by the Roman Catholic Denomination. Bishop, O. E. Mathieu, D.D., is interested in the project.

Saskatoon, Sask.

The sum of \$30,000 was included in the estimates for the erection of a drill hall.

Simcoe, Ont.

The erection of a parish hall for Trinity Church is contemplated and the fol-

lowing committee has been appointed: Canon Hicks (chairman), Judge Robb, Senator, McCall, T. R. Slaght, J. D. Christie, John West, Guy Marston, Geo. Curtis and W. C. McCall.

Sault Ste. Marie, Ont.

A resolution has been forwarded to Hon. Sam Hughes, Ottawa, requesting that a drill hall be erected to meet the requirements of the new regiment.

Stamford Twp., Ont.

The School Board Sec. No. 6 has been authorized to purchase a school site. Building is to start in the spring and be completed by Jan. 1st, 1915.

Steeltown, Ont.

Tenders will be called shortly for a new Methodist Church.

Swift Current, Sask.

Clemesha & Portnall, 1 Credit Foncier Bldg., Regina, have been appointed architects for the high school to be erected at the corner of Grey and Alexander streets.

Thetford Mines, Que.

Plans for additions to the R. C. school on Notre Dame St., have been drawn by Ouellet & Levesque, architect, Quebec, Que.

Toronto, Ont.

Tenders for the Sunday School on St. Clair Ave., for Zion Methodist Church, are invited by C. W. Horton, Homewood Ave., until March 7th. Plans are with the architect, G. M. Miller & Son, 93 Yonge Street.

Tenders will be received by the Board of Education, Sec.-Treas., W. C. Wilkinson, until Feb. 27th, for plumbing in several schools.

Tenders will be received by the Board of Education until Feb. 27th, for carpentry, plastering, painting and plumbing at Connaught school, and for masonry, structural steel work and ash hoist at Harbord St. school.

The Property Committee has passed the estimates of Bldg. Supt. Bishop for additions to 12 schools and the erection of 4 new schools, at an estimated cost of \$2,443,700. The Board will deal with the estimates shortly.

The Property Committee has decided to ask the Board of Control to call tenders at once for the erection of a police station at the Island.

Plans for the new Masonic Temple on Spadina Road have been selected and the judges have awarded prizes as follows:—1st, H. B. Knowles, New York City; 2nd, J. M. Lyle, Leader Lane, Toronto; 3rd, Hutchinson, Wood & Miller, Montreal; 4th, A. W. Gould and A. E. Harvey, Vancouver, B.C. Plans will be on exhibition at the Public Library, College St., after Monday, Feb. 23rd.

The Property Committee has decided to ask the Board of Control to call for new tenders for a police station to be erected on New St., instead of in Ramsden Park.

Toronto, Ont., Newmarket

The Govt. has purchased site for a post office, and work is expected to start this spring.

Toronto, Ont., Norval

Plans for the new Upper Canada College buildings will be ready for tendering

about June 1st. Architects, Sproatt & Rolph, 36 North St., Toronto.

Toronto, Ont., York Mills

Plans for the new St. Andrews College buildings will be ready for tendering about June 1st. Architects, Sproatt & Rolph, 36 North St., Toronto.

Vernon, B.C.

A by-law providing for improvements to the city hall will be submitted to rate-payers.

Victoriaville, Que.

Tenders for a new station for the Corporation of Victoriaville, will be received by Sec.-Treas., J. A. Lacharite until March 3rd.

Vancouver, B.C.

The proposed lodge building for the Northwest Commercial Travellers Association will not likely be erected this year.

Victoria, B.C.

A fund of \$40,000 is being raised by the First Presbyterian Church Congregation for the erection of a new church.

Walkerville, Ont.

The erection of a new church on Lincoln Road, is being considered by the Methodist Church. Further information can be obtained from Wm. Woollatt, A. Mapes or L. D. Galloway.

Winnipeg, Man.

The sum of \$300,000 has been included in the estimates of the Public Works Department.

Waterdown, Ont.

The town council in conjunction with the East Flamboro Twp., has decided to erect a high school building, at a cost of \$25,000.

Windsor, Ont.

Fire Chief Murray recommends the erection of 3 new sub-stations, one in the west side, one in the south and one in the east.

Additions to Tuscarora St. school are being considered by the Board of Education, at an estimated cost of \$20,000, and plans are in progress for a new \$40,000 school on Wyandotte street.

Woodstock, Ont.

Competitive plans for new city hall building are invited. Full information can be obtained from Chairman of Com., Ald. R. D. Montgomery.

CONTRACTS AWARDED

Camrose, Alta.

Read, MacDonald & Brewster, 613 Tegler Bldg., Edmonton, who have the contract for the Normal School have sublet the following contract, heating and plumbing, Ross Bros. Co., Ltd., 39 Griesbach St., Edmonton.

Montreal, Que. (Maisonnette)

The following sub-contracts on the public market have been awarded: Electric clocks, J. T. A. Gaucher, 159 La Salle Ave.; iron gates and steel structure for dome, Can. Architectural Iron Works, 74 St. Dominique; butchers' marble stands, Can. Butchers' Supply Co., 311 Notre Dame E.

Ottawa, Ont.

The general contract for the addition

(Continued on page 77)

Tenders and For Sale Department

Tenders

Tenders will be received by the undersigned until 5 p.m., **March 6th, 1914**, for all trades required in connection with the erection and completion of a new Public School Building to be erected in the Town of Welland. Plans and specifications may be seen at the office of the Contract Record, Toronto, Mr. J. McCaw, Secretary, Public School Board, Welland, Ont., and A. E. Nicholson, Architect, 46 Queen Street, St. Catharines, Ont.

The lowest or any tender not necessarily accepted.

A. E. NICHOLSON, O.A.A., Architect,
7-8 46 Queen St., St. Catharines, Ont.

Stone Macadam Road

Sealed tenders will be received up to noon on the **2nd day of March, 1914**, by the undersigned at Cayuga, Ont., for the construction of twenty-six and one-half miles of stone macadam road in the County of Haldimand. The work will be let in three separate and distinct contracts, not necessarily to the same individual. Tenderers should tender for each contract separately. The work to be done on Contracts Nos. 1 and 2 is situated on the Hamilton and Port Dover Plank Road, and that on Contract No. 3 is situated on the Talbot Road. Each section has convenient shipping points.

Tenderers are requested to examine the localities of the work and plans and specifications for the same may be seen at the office of the County Engineers, Messrs. Jackson & Kyd, Dunnville, or may be had from them on the payment of \$10.

Lowest or any tender not necessarily accepted.

T. A. SNIDER, K.C., County Clerk,
5-8 County of Haldimand, Cayuga, Ont.



Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Aurora, Ont.," will be received at this office until 4 p.m., on **Monday, March 16, 1914**, for the above mentioned work.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Aurora, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering declines to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, February 20, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—55944. 8-9



Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Walkerville, Ont.," will be received at this office until 4 p.m., on **Monday, March 16, 1914**, for the above mentioned Public Building, Walkerville, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at the Post Office, London, Ont., at the Post Office, Walkerville, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering declines to enter into a contract when called upon to do so, or fails to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, February 20, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—55946. 8-9

Tenders for Cement Walks

Tenders will be received by the undersigned, until 6 p.m. **Saturday, February 28th, 1914**, for the construction of certain Granolithic Walks in the Town of Sudbury.

Approximating 8240.9 lineal feet.

Locations, specifications and forms of tender may be obtained by application to Town Clerk, Sudbury.

Tenders to be sealed and marked "Tenders for Cement Walks."

The lowest or any tender not necessarily accepted.

Marked cheque for five per cent. of value of work to accompany tender.

Granolithic walks other than above are in contemplation for the season of 1914.

Dated at Sudbury this 29th day of January, 1914.

5-8

W. J. ROSS, Town Clerk,

CITY OF LONDON, ONT.

Tenders for Supply of Road Oil and Sprinkling Equipment

Sealed tenders addressed to the "Chairman and Members of the Board of Control," will be received at the office of the City Clerk until 5 p.m. on **Thursday, the 13th March, 1914**, for the supply of:—

125,000 Imperial Gallons No. 4 Standard Asphaltic Road Oil.

Two Road Oil Pressure Sprinklers.

Specifications and all particulars can be obtained at the office of the City Engineer.

The lowest or any tender not necessarily accepted.

C. M. R. GRAHAM, Mayor,
Chairman Board of Control.
London, Ont., Feb. 23rd, 1914. 8-9

The Village of Point Edward Province of Ontario

Tenders for Water Works

Sealed tenders registered and clearly marked on the outside of the envelope:—Tender "A" or "B" as the case may be and addressed to the Village Clerk, Point Edward, Ontario, will be received up to 8 p.m. **Saturday, February 28th, 1914**, for the supply of material and the construction of:—

Contract "A"—Labor of laying approximately 4,000 feet of 6-inch pipe

10,000 feet of 4-inch pipe

with valves, hydrants, etc.

Contract "B"—Furnishing Cast Iron or Steel Water Pipes and Specials.

Contract "C"—Furnishing Valves, Hydrants, Cocks, Lead Pipe, etc.

Copies of plans, specifications, instructions to bidders, etc., may be seen at the office of H. A. McLean, Engineer, Room 5, Town Hall, Sarnia, or at the office of the Contract Record, Toronto, on and after February 7th, 1914.

Persons tendering are notified that tenders will not be considered unless made on forms supplied. Forms will be mailed upon request to the Engineer or Clerk.

Dr. A. S. McLaren, Reeve,
D. J. McDougall, Chairman of
Fire and Water Committee.

Point Edward.

7-8



Sealed tenders addressed to the undersigned, and endorsed "Tender for Centre Pier at Cobourg, Ont.," will be received at the office until 4 p.m., on **Wednesday, March 11, 1914**, for the construction of the Centre Pier at Cobourg, Northumberland County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the offices of the District Engineers, Confederation Life Bldg., Toronto, Ont.; Windsor, Ont., and on application to the Post-master at Cobourg, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering declines to enter into a contract when called upon to do so, or fails to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, February 10, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—55514. 7-8

Tenders Received

Tenders will be received by the undersigned up to 5 p.m., **Monday, March 2nd**, for approximately 25 Fire Hydrants. Full particulars may be had at the office of the City Engineer.

The lowest or any tender not necessarily accepted.

M. FERGUSON,

St. Thomas, February 16 1914. City Engineer.
7-8

CITY OF MONTREAL

Automobile Fire Trucks and other Apparatus

Sealed tenders addressed to the Board of Commissioners and deposited in their Office in the City Hall, will be received until twelve o'clock noon, on **Thursday, the 26th day of March, 1914**, for the supply and delivery of the undermentioned apparatus, viz.:-

- (a) One Automobile Salvage Waggon.
- (b) Four Automobile Tractors.
- (c) Two Automobile Hose Waggon.
- (d) One 85 ft. Aerial Ladder, Automobile Truck.
- (e) One Automobile Fire Engine, of a capacity of 1200 American Gallons.

Specifications, forms of tender and envelopes, together with all information required, may be obtained at the Office of the Purchasing and Sales Agent, City Hall, and no tender will be considered unless made on said forms and enclosed in said envelopes.

The Board of Commissioners reserve the right to reject all or any of the tenders.

The tenders will be opened by the Board of Commissioners in the presence of the interested parties, at their regular meeting in their Board Room at the City Hall, at twelve o'clock noon, on **Thursday, the 26th day of March, 1914**.

By order of the Board of Commissioners,

L. N. SENECA, Secretary.

Board of Commissioners' Office,

City Hall,

Montreal, February 10th, 1914.

7-8



Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Palmerston, Ontario," will be received at this office until 4 p.m. on **Monday, March 9, 1914**, for the construction of the building mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, Ont., The Postmaster, Palmerston, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,

Secretary.

Department of Public Works,

Ottawa, February 13, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.

47749

7-8



Mail Contract

Sealed tenders, addressed to the Postmaster General, will be received at Ottawa until noon, on **Friday, the 20th of March, 1914**, for the conveyance of His Majesty's mails, on a proposed Contract for four years, six times per week each way, over Locust Hill (via Green River, Brougham, Whitevale and Greenwood) Rural Mail Route, from the Postmaster General's pleasure.

Printed notices containing further information as to conditions of proposed Contract may be seen and blank forms of Tender may be obtained at the Post Offices of Locust Hill, Green River, Brougham, Whitevale, Greenwood, and at the office of the Post Office Inspector, Toronto.

A. SUTHERLAND,

Post Office Inspector.

Post Office Inspector's Office,
Toronto, February 3rd, 1914.

6-7-8

Tenders Wanted

Sealed tenders will be received by the undersigned for lump sum or separate tenders for all trades required in the alterations and additions to the Registry Office for the County of Welland in the Town of Welland, up to 12 o'clock noon, **Tuesday, March 3rd, 1914**.

Plans and specifications may be seen at the office of the County Clerk, Welland, Ont.; office of A. E. Nicholson, architect, of St. Catharines, Ont., and the office of the Contract Record, Toronto, Ont.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of H. J. Knoll, Warden, or two personal sureties approved of by the Warden, equal to 10 per cent. of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The County does not bind itself to accept the lowest or any tender.

Tenders to be marked on envelope "Tender for Registry Office."

ROBERT COOPER, County Clerk,

6-8

Welland, Ont.

CANADIAN PACIFIC RAILWAY COMPANY

DEPARTMENT OF NATURAL RESOURCES

ENGINEERING BRANCH

TENDERS FOR TIMBER STRUCTURES

Sealed tenders, addressed to the undersigned and endorsed "Tenders for Timber Structures," will be received up to noon of **March 14th, 1914**.

The work to be let includes the timber (irrigation) structures in about half the area of the Eastern Section of the Company's Irrigation Block in Alberta.

Approximate quantities are 3,550,000 feet B.M. of timber and 18,000 cubic yards of excavation. All construction materials will be furnished by the Railway Company.

Plans, specifications and full information will be furnished on application to the undersigned. A deposit of \$50 will be required before plans, etc., will be given out, which will be refunded on their return in good condition.

All proposals must be accompanied by a certified cheque, payable to the undersigned, for five per cent. (5 p.c.) of the amount of the tender, to be forfeited as liquidated damages should the bidder neglect or refuse to enter into a contract if the work is awarded to him.

All proposals must be made on the standard form provided or they will not be considered. Any alterations thereto, interlineations or qualifying of prices may invalidate the proposal.

The right is reserved to reject any or all bids and to waive defects.

A. S. DAWSON,

Chief Engineer.

Calgary, Alberta.

8-10

CITY OF SASKATOON

Tender for Cast Iron Pipe and Specials

Sealed tenders, addressed to the City Commissioners, Saskatoon, and endorsed "Tender for Cast Iron Pipe and Specials," will be received up to noon on **Tuesday, March 10th, 1914**, for the supplying of the following material:-

- 12 tons Class "A" Cast Iron Pipe, 12-in.
- 65 tons Class "B" Cast Iron Pipe, 12 to 24 in.
- 13 tons Class "B" Specials, 12 to 24 in.
- 9 Gate Valves 12 to 20 in.

The Corporation reserves the right to divide the material into three contracts, and to reject any or all tenders.

All information may be obtained on application to Mr. Junius Jonsson, Acting City Engineer.

F. E. HARRISON, Mayor,

Chairman of City Commissioners,

Saskatoon, February 7th, 1914.

7-8



Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, March 3rd, 1914**, for the construction of the following sewers, viz.:-

Clendennan Ave., from Annette St. to Dundas St.
Danforth Ave., from Woodbine Ave. to Main St.
Evelyn Ave., Annette St. to St. John's Road.
Fairview Ave., from Annette St. to St. John's Rd.
Gillard Ave., from Felstead Ave., Danforth Ave.
Grace Terrace, from Heath St. to Moore Ave.
Hannaford St., from Kingston Rd. to Gerrard St.
Heath St., from Grace Terrace to McClintock St.
Hillsview Ave., from Keele St. to West Limit
Lot No. 21, Plan 587.

Jennings St., from Clendennan Ave. to W. End.
Keele St., from Conduit St. to Annette St.
Kennedy Ave., from Bloor St. to Glenwood Ave.
Kimberley Ave., from Lyall Ave. to Gerrard St.
Kent Rd., from Queen St. to North End.
Kingswood Ave., from Queen St. to Gerrard St.
Lane first west of Crawford St., Harbord St.
to lane second south of Bloor St.

Lawes Ave., from Annette St. to St. John's Rd.
Lawlor Ave., from Kingston Rd. to Gerrard St.
Lyall Ave., from Main St. to Wayland Ave.
Melgund Rd., from Wells Hill Ave. to 120 ft. N.
Moore Ave., from Fern St. to Grace Terrace.
Osborn Ave., from Lyall Ave. to Gerrard St.
Pleasant Ave., from Grace Terrace to east end.
Quebec Ave., from Annette St. to Dundas St.
Rosehill Ave., from Grace Terrace to west limit,
Lot No. 1, Plan 920-K.

Rosepark Ave., from Grace Terrace to Welland Ave.

Rowland St., from Clendennan Ave., to W. End.
Runnymede Rd., from Annette St. to Clair Ave.
St. Clair Ave., from Grace Terrace to Welland Ave.

Wamsley Blvd., from Baker Ave., to Lawton Ave.
Wayland Ave., from Lyall Ave. to Gerrard St.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenders shall submit with their tender the names of two sureties (approved by the City Treasurer, not members of the City Council or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,

Chairman, Board of Control.

Toronto, February 12th, 1914.

8

CITY OF NORTH BATTLEFORD SASKATCHEWAN

Tenders for Cast Iron Pipe and Sewer Pipe

Sealed tenders marked "Tenders for Sewer Pipe," or "Tender for Cast Iron Pipe," will be received by the City Commissioners till 12 o'clock noon, **Monday, March 16th, 1914**, for furnishing the City of North Battleford with cast iron water pipe and vitrified tile sewer pipe for the year 1914 in accordance with the specifications on file at the offices of the Engineers, Messrs. Chipman & Power, Mail Building, Toronto; 47 Canada Life Bldg., Winnipeg; and at North Battleford, Sask.

The lowest or any tender not necessarily accepted.

J. A. FOLEY,

H. W. DIXON,

J. B. STIRLING, City Commissioners.

CHIPMAN & POWER, Engineers,

Toronto and Winnipeg.

North Battleford, Feb. 17, 1914. 8-9



TENDERS

Sealed tenders, addressed to the Secretary of the Department of the Interior, Ottawa, Ont., and marked "Tenders for Bathhouse, Banff," will be received up to noon, **March 16th, 1914**, for the construction of a bathhouse at Banff, Alta.

Plans and specifications may be seen at the offices of the following:—

The Commissioner of Dominion Parks, Ottawa.

The Superintendent of Rocky Mountains Park, Banff, Alta.

The Chief Superintendent of Dominion Parks, Edmonton, Alta.

Agent of Dominion Lands, Calgary, Alta.

Agent of Dominion Lands, Winnipeg, Man.

Agent of Dominion Lands, Regina, Sask.

Immigration Agent, Vancouver, B.C.

The lowest or any tender not necessarily accepted.

The unauthorized insertion of this advertisement in any newspaper will not be paid for.

LYNDWODE PEREIRA,

Secretary.

Department of the Interior,

—55384. Ottawa, Feb. 4th, 1914.

7-8

Tenders Wanted

Sealed tenders will be received by the undersigned, addressed to John Allan, Mayor, Chairman, Board of Control, City Hall, Hamilton, up to 5 o'clock p.m. on **Wednesday, March 4th, 1914**, for supplying the Corporation of the City of Hamilton with the following:—

Cement, Sewer Brick, Lime, Sewer Pipe, Castings, Creosoted Wooden Blocks, Road Oil, Rubber Boots, Vitrified Brick, Flux, Gravel, Lumber, Lead Pipe, Pig Lead, Iron Pipe, Valves, Hardware, Hydrants, Extension Boxes, and Brass Work for Water Department.

Tenders must be on forms supplied.

Specifications for all of the above can be obtained at the office of the Secretary of the Works Department, Hamilton, where forms of tender can also be obtained.

Tenders will also be received for printing the Assessment and Tax Forms, and Financial Statement, specifications for which can be obtained at the City Clerk's office.

A marked cheque for 10 per cent. of the amount of tender (unless otherwise stated in specifications), payable to W. R. Leckie, City Treasurer, must accompany each tender, which will be forfeited, should the tenderer and his sureties fail to execute contract within four days after acceptance by the City.

The lowest or any tender not necessarily accepted.

S. H. KENT, City Clerk.

Hamilton, Feb. 19, 1914.

8

To Architects

With a view to encouraging the erection of summer cottages on the shores of Lake Couchiching and Lake Simcoe, the Orillia Board of Trade offers two prizes of \$25 each for the best plans and specifications for summer cottages which can be erected for \$500 and \$800 respectively. It is proposed that a fee shall be paid for any plan of which use is made, whether it wins a prize or not. Plans must be filed by March 20th. For further terms and conditions, address Secretary, Board of Trade, Orillia. 8

CANADIAN PACIFIC RAILWAY COMPANY

DEPARTMENT OF NATURAL RESOURCES

ENGINEERING BRANCH

TENDERS FOR CONCRETE CONSTRUCTION

Sealed tenders, addressed to the undersigned and endorsed "Tenders for Concrete Structures," will be received up to noon of **March 14th, 1914**. The work to be let includes the concrete (Irrigation) structure in about half of the area comprising the Eastern Section of the Company's Irrigation Block, Alberta. Materials, except for forms, will be furnished by the Company. Materials for forms and all labor must be furnished by the Contractor. The approximate quantities are:—3,800 cubic yards of concrete and 192,000 pounds of reinforcing steel. The quantities in individual structure vary from 15 cubic yards to 80 cubic yards.

Plans, specifications, and full information will be furnished on application to the undersigned. A deposit of \$50.00 will be required before plans, etc., will be given out, which will be refunded on their return in good condition.

All proposals must be accompanied by a certified cheque, payable to the undersigned, for five per cent. of the amount of the tender, to be forfeited as liquidated damages should the bidder neglect or refuse to enter into a contract in the event that the work is awarded to him.

Proposals must be made on the standard form provided. Alterations thereto, interlineations or qualification of prices may invalidate the bid.

The right is reserved to reject any or all bids and to waive defects.

A. S. DAWSON,

Chief Engineer.

Calgary, Alberta.

7-9



Sealed tenders addressed to the undersigned, and endorsed "Tender for Harbour Improvements at Wellington, Ont.," will be received at this office until 4 p.m., on **Monday, March 16, 1914**, for the construction of Harbour Improvements at Wellington, Prince Edward County, Ontario.

Plans, specification and form of contract can be seen and forms of tender obtained at this Department and at the office of the District Engineer, Confederation Life Building, Toronto, Ont., and on application to the Postmaster at Wellington, Ont.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering declines to enter into a contract when called upon to do so, or fails to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,

Secretary.

Department of Public Works,

Ottawa, February 16, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—55693.

7-8

TENDERS

Sealed tenders will be received by the undersigned up to 7 o'clock March 7, for the erection of a Sunday School Building for Zion Methodist Church, St. Clair Ave. The lowest or any tender not necessarily accepted. Plans may be obtained from Architect Miller, 93 Yonge street, or from the Secretary, C. W. Horton, Humewood Ave.

TENDERS

To Contractors

Tenders will be received up to 5 p.m., Tuesday, March 3rd, for brick work, steel work, terra cotta, carpenter work, painting and plastering required in the complete remodelling of store at 234 Yonge street, for Messrs Bachrack Bros. Plans and specifications can be seen and all particulars obtained at the office of

F. H. HERBERT, Architect,

65 Adelaide Street East.

8

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent., an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929 Contract Record, Toronto. 53-12

City of Wetaskiwin, Alberta

Drilling Gas Wells

Sealed tenders will be received by the undersigned up to Tuesday, March 17th, 1914, for drilling one or two natural gas wells in the City of Wetaskiwin to a depth of from 1,500 to 2,000 feet. The price per foot for either one or two wells to be given with contractor furnishing all material, fuel and water and otherwise. Further particulars with copy of log of well at present in operation will be furnished upon application.

The lowest or any tender not necessarily accepted.

E. ROBERTS,

Secretary-Treasurer

8

THE TORONTO HARBOR COMMISSIONERS

Tender for Retaining Wall

Sealed tenders addressed to the undersigned and endorsed "Tender for Retaining Walls—Don Diversion," will be received at the Toronto Harbor Commissioners' Office, 50 Bay Street, Toronto, until 4 p.m., **Monday, March 9, 1914**.

Plans and specifications can be seen and forms of tender obtained at 76 Adelaide Street West, Toronto.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Toronto Harbor Commissioners, equal to five (5) per cent. of the amount of the tender; if the tender be not accepted the cheque will be returned.

The Toronto Harbor Commissioners reserve the right to reject the lowest or any tenders.

TORONTO HARBOR COMMISSIONERS,

Alex. C. Lewis, Secretary.

Toronto, February 23rd, 1914.

8

For Sale

Dredge, Tug and Scows
L. BROOKS,
8-9 455 Ontario St., Toronto

For Sale

One standard gauge locomotive in operating condition. Cylinders 24 in. x 18 in.
The Jenckes Machine Company, Ltd.,
6-19 Sherbrooke, Que.

For Sale

Thirty Standard Gauge Flat Cars in good condition; will pass M.C.B. inspection; 30 ton capacity, equipped with air brakes.

JOHN J. GARTSHORE,
7-8 Toronto, Ont.

WANTED

A second hand 12 or 14 yard clam shell bucket. Apply to

BOWMAN & CONNOR, Engineers,
8 36 Toronto Street, Toronto.

AGENTS WANTED FOR CONCRETE MIXERS

A large Canadian firm about to manufacture concrete mixers on an extensive scale wants sales agents in Ontario, Quebec, Maritime Provinces, Winnipeg, Calgary, Vancouver. Apply Box 962, Contract Record, Toronto. 6-8

Town Engineer Wanted TOWN OF MELVILLE SASKATCHEWAN

Applications will be received by the undersigned until six p.m., Monday, March 16th, 1914, for the position of engineer for the Town of Melville. Applicants will please give details of experience in sewage installation and other branches of work, and state salary required.

By order,
FRED. H. CLARKSON,
8-9 Town Clerk.

Wanted Employees**WANTED—SALES AGENTS**

A large Michigan firm manufacturing concrete mixers wants to secure reliable sales agents for Ontario, Quebec and Eastern Canada. A liberal proposition will be made to any firm having a good organization to cover the whole or part of this territory. Apply Box 959, Contract Record & Engineering Review, Toronto. 6-8

Public Buildings, Churches, Schools, &c.

(Continued from page 73)

to the University has been awarded to C. E. Deakin, 41 Mayor St., Montreal. The sub-contracts are not let yet.

Port Arthur, Ont.

The contract for the erection of the customs house has been awarded by the Public Works Dept., to Marsh, Hutton, Powers Co., Port Arthur.

St. John, N.B.

Rhodes Curry Co., Amherst, N.S., who

have the contract for the post office on Prince William St., have sub-let the following contract, plumbing, J. Hague, Amherst, N.S.

Toronto, Ont. (Weston)

The following contracts on the Carnegie Library have been awarded: Kenerall contractor, Geo. Sainsbury, Colter Ave., Weston; leaded glass, J. McCausland & Son, 11 Nelson St., Toronto; mosaic work, Italian Mosaic & Marble Co., Crown Tailoring Co. Bldg., College and Euclid, Toronto. Architects, Lindsay & Brydon, Trinity Sq., Toronto.

Vancouver, B.C.

The contract for the erection of the Fraternal Order of Eagles lodge hall has been awarded to Hosking Construction Co., 1141 Alberni Street, \$42,500.

Business Buildings and Industrial Plants

Aurora, Ont.

Mr. Shulman, who is considering the erection of a garage, is negotiating with the council regarding taxes.

Alliston, Ont.

The Dominion Gas Tractor Co., Ltd., has completed negotiations for locating in the town.

Belleville, Ont.

Woolworth & Co., New York and Toronto, Ont., have leased 2 stores on Front street, and will have extensive alterations made.

Blairmore, Alta.

The Keystone Cement Co. will start work on their new factory as soon as weather conditions will permit.

Chatham, N.B.

W. & R. Walsh, Wellington St., have nearly completed their plans for the erection of a sash and door factory.

Galt, Ont.

A proposition has been suggested to the water commission to establish an ice making plant in connection with the waterworks, for the supply of pure ice.

Hamilton, Ont.

Work on the dry kiln and machine shop for the Canadian Sewer Pipe & Clay Products Co., Ltd., will start as soon as weather conditions permit.

Melville, Sask.

The Dom. Milling Co., Ltd., has under consideration the construction of a flour mill with a capacity of 300 bbls. per day.

Montreal, Que.

H. Dunlap Morrison, 454 Old Birks Bldg., architect, will receive tenders about April 1st for the erection of a \$200,000 office building on Phillips Pl.

Tenders for the remodelling of stores at 34-36 Notre Dame West are being called by J. Rawson Gardiner, architect, 49 Beaver Hall Hill.

F. W. Stair, Stair Bldg., Toronto, is negotiating for a site on St. Catherine St. near Bleury St. and will erect a large burlesque house of steel and brick construction with the latest theatre appliances.

Tenders for the erection of stores and offices on Peel St., for J. R. Binning, 1090 Queen Marys Rd., will be received

by Saxe & Archibald, Beaver Hall Hill, architects, till March 1st.

Plans for stores on Panet and St. Catherine Sts., are being drawn for Mr. Francois Martineau, by E. Prairie, 502 St. Catherine E., architect, who will call tenders for general contractor, March 15th to March 25th. Estimated cost, \$45,000.

Medicine Hat, Alta.

Fry's, Ltd., Bristol, Eng., have purchased a site for the erection of an industrial plant, but work may not start for some time yet.

Orillia, Ont.

The erection of a planing mill on West St., is being considered by J. R. Eaton & Sons, Andrew and Colborne Sts., who have asked the town council to grant a site in addition to assisting them by means of a loan. If satisfactory arrangements can be made, a by-law will be submitted to ratepayers as early as possible.

Owen Sound, Ont.

The Northern Bolt & Screw Co., 17th St. E., have certain additions to their factory under consideration.

It is understood that additions to the plant of the Canada Malleable Iron Co., Ltd., 3rd Ave. E., are contemplated.

The McQuay Tanning Co., 1852 3rd Ave. E., will probably enlarge their present buildings.

Wm. Kennedy & Sons Co., 1114 1st Ave. W., are planning to enlarge their present building.

Point Grey, B.C.

Tegen & Vezina, architects, 807 Metropolitan Bldg., Vancouver, are preparing plans for stores and apartments on 10th Ave., and will call for tenders in about a month's time.

Port Stanley, Ont.

The Producers' Fish Co., Ltd., proposes to erect a fertilizing plant for which machinery will be required.

Quebec, Que.

The Commission of the Quebec Provincial Exhibition invite competitive plans from architects and civil engineers for designs, etc., for steel and concrete grand stand, with a seating capacity of 8,000. Competition closes March 10th. 1st prize, \$500; 2nd, \$300; 3rd, \$200. Full information from Sec. Georges Morisset, City Hall.

Regina, Sask.

A site on Winnipeg Street has been granted to Leitch Bros., Oak Lake, Man. for the erection of an elevator to cost \$300,000.

The Independent Tire Co., Galt, Ont., has made an application to the council for a site for the erection of a 2-storey warehouse.

The sum of \$6,500 has been approved by the council for the erection of a machine shop.

Leitch Bros., Oak Lane, Man., contemplate erecting an elevator, with a capacity of 300,000 bushels; a flour mill, with a capacity of 3,000 bbls.; an oatmeal mill, with a capacity of 200 bbls.; and a cooperage and bag factory.

Roche Point, B.C.

The Vancouver Lumber Co., Ltd., will make extensive alterations to their cedar

mill, and will install machinery to the value of \$75,000.

Strathroy, Ont.

The ratepayers voted a grant to help the Canadian Handles Co. erect a factory in place of that recently destroyed by fire.

St. Catharines, Ont.

Shurly & Dietrich, whose plant at Galt was recently destroyed by fire, will probably make addition to their plant here.

St. John, N.B.

A store and office building, costing \$15,000, will probably be erected by the Canadian Bible Society, 14 College St., Toronto, Ont. Sec., Geo. A. Henderson.

St. Thomas, Ont.

Plans for a \$35,000 hotel are being prepared for A. P. Conley, who intends erecting a new building to replace the Arlington Hotel, recently destroyed by fire. Architect, John T. Findlay.

The Bank of Montreal are looking for a suitable site for the erection of a branch here.

Sault Ste. Marie, Ont.

Tenders for the erection of stores and residences on Queen Street are invited by C. A. Findlay, architect, Pim Street.

Thorold, Ont.

Wm. C. Wilson and Co., Chappell St. and St. David's Road, are interested in the probable building of an artificial ice plant with a capacity of four tons of ice per day.

Toronto, Ont.

H. G. Horton, 124 Westmount Ave., has purchased 40 feet frontage on St. Clair Ave., near Lauder Ave., for the erection of stores and apartments.

Plans for an office building at the corner of Yonge and Isabella Sts., have been drawn for R. C. Busted, Confed. Life Bldg.

Jas. Manchester, 1632 Dufferin Sts., intends to erect a hall for concerts, dances, etc., on the site purchased for theatre, at the corner of Elmwood and St. Clair Ave.

Plans are being prepared for the erection of a bank building on the southeast corner of Yonge and Queen Sts., for the Imperial Bank of Canada. Architects, Darling & Pearson, Leader Lane.

Plans are being prepared for stores and offices at the corner of Yonge and Albert Sts., for John Stark & Co., 26 Toronto St. (in trust). Architect, F. H. Herbert, 65 Adelaide E.

Vancouver, B.C.

Negotiations for the erection of a \$250,000 theatre for Alex. Pantages, Seattle, Wash., are being handled by A. L. Hampton, care Hampton & Edgar, 532 Granville Street. Probable architect, B. Marcus Pretica, Seattle, Wash.

Tenders for the factory for the Royal Crown Soaps, Ltd., will not be called now for at least 2 months. Architect, Thos. Hooper, Winch Bldg.

White Rock, B.C.

The erection of a 3 or 4-storey hotel is being considered by the White Rock Resort Development Co., Ltd., 619 Hast-

ings St. W., Vancouver, who also contemplate the construction of an overhead bridge to the shore end of pier, a cement pier 400 ft. long, with jetty 16 to 20 ft. wide, picture theatre, dancing pavilion, boathouse, bath house, etc.

Winnipeg, Man.

Plans for a business block on Higgins Ave. for B. Fousect, Wolseley Hotel, 186 Higgins Ave., have been drawn by Woodman & Carey, Lindsay Bldg. Tenders will be called shortly.

Wainwright Alta.

W. MacLean is interested in the contemplated erection of an elevator here.

CONTRACTS AWARDED

Edmonton, Alta.

The contract for the alterations to A. G. Baalim's store on Whyte Ave., has been awarded to General contractor, W. Evans, c/o Manning Co., Edmonton.

Hamilton, Ont.

The following additional contract on the three stores and apartments building on Barton St. E., for W. R. Turnbull, has been awarded: Carpentry, G. W. Dorking, 182 Caroline St. S.

Montreal, Que.

The contract for alterations to Imperial Oil Company's factory has been awarded to Jas. Shearer & Co., 225 St. Patrick Street.

Contracts in connection with the re-modelling of the stores and club premises of S. L. E. Cuddy, on St. Catherine St., have been awarded to, stone and brick, Jno. Quinlan, 4412 St. Catherine W.; carpentry, J. B. Gratton, Ltd., 82 Mercier Ave.; steel, Dom. Bridge Co., Lachine.

The contract for the erection of stores and flats on Van Horne St., for H. M. Levine, 56 St. Joseph Blvd. W., has been awarded to Hutchison & Bernard, care Architects.

Montreal, Que., Lachine

The contract for additions to the plant and erection of storage for Messrs. Daly & Moin, St. Paul St., Montreal, has been awarded to A. Gauthier, Lachine.

Ottawa, Ont.

The following contracts have been awarded in connection with the alterations and addition to the office of the Capital General Trust Co., Sparks St. Carpentry, Smith Bros., 448 McLeod St.; interior fittings, Jno. McLachlan, 989 Somerset St.

Redcliff, Alta.

The contract for the knitting factory for Dr. Bonner, has been awarded to J. C. Reid. Work is to start about March 1st.

Toronto, Ont.

The following contracts in connection with the alterations to building on Bay St., for G. S. McConkey, have been awarded. Mason day labor. Carpenter, E. Gearing, 144 Wilton Ave. Marble, Hoidge Marble Co., 34 Price.

Victoria, B.C.

The contract for the departmental store, at the junction of Herald, Douglas and Fishguard Sts., for the Hudson's Bay Co., has been awarded to British Columbia Constr. & Engineering Co., 520 General Bldg., Victoria. Excavating is finished and construction work will

start shortly. Architects, Burke, Horwood & White, 28 Toronto St., Toronto, Ont.

Residences

Britannia, Ont.

The erection of a cottage here is contemplated by the Kings Daughters Guild, Laurier Ave., Ottawa.

Hamilton, Ont.

B. C. Arndt, 547 Main E., is considering the erection of three residences at an estimated cost of \$10,000.

Lambeth, Ont.

Plans for a bungalow, to cost \$5,000 for J. Ross, have been drawn by W. G. Murray, Dom. Savings Bldg., London.

London, Ont.

Plans are in progress for an apartment house at the corner of Kent and Richmond Sts., for R. A. Y. Stinchcombe Wharncliffe Road, London West. Architect, A. E. Nutter, Dundas and Richmond Sts.

The erection of two residences to cost \$10,000, is being considered by J. McLeod, c/o McLeod Nolan & Co.

Geo. Hardy, Yale St., has under consideration the erection of an \$8,000 residence.

W. J. Blackie, 205 Cheapside St., proposes to erect a residence at a cost of \$6,500.

Montreal, Que. (Notre Dame de Grace).

Wright & Son, architects, 204 St. James St., are receiving tenders for a \$14,000 residence for Mr. P. Earle.

Montreal, Que. (Outremont)

Plans for an apartment house to cost \$50,000 have been drawn for L. A. Beauchemin, 402 Bleury St., who will call for all trades except heating, ventilating, refrigerators, electric wiring and hot water system, about March 1st. These trades to be called for by Fred M. Hoadley, 58 Beaver Hall Hill, about April 1st.

Montreal, Que. (St. Lambert)

Mr. J. R. Morton, 2475 Hutchison St., Montreal, contemplates building a residence here.

Montreal, Que.

Plans for a \$35,000 3-storey apartment house on Christopher Columbus Street for Laroque & Bernard, 1654 Esplanade, Montreal, are being drawn, and tenders will be called about March 15.

Sub-tenders for heating, plumbing and electric fitting on alterations to several residences on Lincoln St. will be received by J. S. Prince, 4371 Montrose Ave., about March 1st.

Tenders for the erection of a four-storey apartment house on St. Joseph Blvd., are invited by Latour & Guindon, 52 St. James St. Contract will be awarded shortly.

Plans are in progress for a residence on Mance, to cost \$10,000, for Mr. Thomas, 23 St. Joseph Blvd. W. Architect, Z. Trudel, 238 St. Andre St.

L. A. Content, 17 Place D'Armes Hill, will probably build flats on Sherbrooke St.

D. J. Crighton, Jacobs Bldg., St. Catherine, architect, will receive tenders until

(Continued on page 80)

“Inglis” Corliss Engines

are known above all others as being pre-eminently “Engines of Quality,” Economical, Durable and Reliable and can be depended upon to give the same good results twenty years from now.

We build them Single, Tandem, Compound and Triple, for heavy or light duty. Remember our Fifty year reputation is back of every “INGLIS” engine. Specifications and prices upon request.

The John Inglis Company

ENGINEERS AND BOILERMAKERS

Limited

14 Strachan Ave.,

Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Feb. 27th, for the erection of flats on St. Urbain St., estimated to cost \$15,000.

Ottawa, Ont.

The Presbyterian Church Congregation propose to build a manse for their Pastor, the Rev. Thomas J. Thompson, at a cost of \$8,000.

The following additional contract on J. W. Nelson's residence on 3rd Ave., has been awarded. Heating and plumbing, J. P. Band, 344 Frank.

Point Grey, B.C.

Plans for 18 residences are being drawn by Tegen & Vezina, 807 Metropolitan Bldg., Vancouver, for four of which tenders are invited.

Reston, Man.

Tenders for the Presbyterian Church Manse will be received by Secretary, Board of Management, A. K. Gates, until February 26th.

Toronto, Ont.

Plans for one pair of residences on Ravina Cres., have been drawn for W. Williams, 116 Jones Ave., who will superintend the construction.

Plans for the erection of one detached residence to cost \$7,000, cor. Pleasant and Avoca Sts. are being drawn for P. W. Colman, 167 Robert St., by J. G. Hedges, 210 Clinton Street.

Plans for three attached stores and residences on Roncesvalles Ave., for R. C. Bustard, 7 Queen St. E., are being drawn; estimated cost \$12,000.

James Shier, 1308 Lansdowne Ave., has purchased a site on Westmount Ave. and proposes to erect a residence thereon.

Morris Dennis, 143 Wellington St. W., has purchased 50 ft. frontage on Mackay street and will erect three residences in the spring.

Plans for two detached residences on Gilmour Ave., have been drawn for H. Grenblatt, 2221 Dundas Street.

Plans for two family apartments are being drawn by J. A. Thatcher, 31 Queen St. W., and will be ready for tendering about March 5th.

Tenders closing March 2nd for the erection of a residence on Hillcrest Drive are invited by S. B. Coon & Son, architects, 512 Temple Bldg.

Capt. A. Ure, 122 Westmount Ave., has purchased a site with 30 ft. frontage on Westmount and intends erecting a \$10,000 residence thereon.

H. Simpson, architect, 82 King Street E., is open to receive tenders for a \$10,000 residence on Russell Hill Drive for Mr. McQuillan.

Plans are drawn for three attached residences on Greenlaw St. for A. G. Saunders, 39 Havelock. Owner superintends construction.

J. W. Clare, Ascot Ave., has purchased a site at the corner of St. Clair Ave. and Ascot Ave. and contemplates erecting 3 residences.

Vancouver, B.C.

A permit for a residence to cost \$8,000 has been issued to S. S. Selman, 1100 Nelson St. Architect, J. P. Matheson & Son, 509 Richard St.

Windsor, Ont.

Tenders for a double residence on Pilissier St. to cost \$7,000, will be received by J. C. Pennington, architect, until March 1st.

Tenders for a \$12,000 residence on Victoria St., for Walter Bartlett, will be received by J. C. Pennington, architect, until March 1st.

The erection of an apartment house on Langlois St. to cost \$16,000, is being considered by M. D. Armally. Architects, G. Jacques & Co.

Winnipeg, Man.

Plans for an apartment block on McMillan Ave., to cost \$24,000, have been drawn by Walley Construction Co., 408 McArthur Bldg.

Tenders for the Rectory for St. Luke's Church, Stradbroke Place, will be received by Woodman & Carey, architect, Lindsay Bldg., until Feb. 28th.

Plans for an apartment block on Victor St. to cost \$35,000, have been drawn for Goodman & Benson, 688 Victor St., by G. Olafson, architect. S. Brynjolfsson & Sons, Exchange Bldg., is the general contractor.

CONTRACTS AWARDED

Victoria, B.C.

The contract for Mrs. Catherine S. McPherson's residence on Douglas St. has been awarded to W. Bownass.

Power Plants, Electricity and Telephones

Edmonton, Alta.

The following amounts have been approved by the city council: \$558,260 for the completion of and extension to the power plant; \$156,173 for the installation of a telephone system; \$174,214 for extensions to the electric lighting system.

The City Council has decided upon the purchase of 2 6,000 kw. turbo generators.

Peterboro, Ont.

One mile of railway line will be constructed by the Canadian General Electric Co. for the purpose of testing locomotives, provided the company can secure permission from the city to lay tracks on the public highway.

Port McNicoll, Ont.

Tenders received by Thos. Nottingham, Chairman Hydro Commission, for about 100 25-ft. and 30-35 ft. hydro electric poles.

Regina, Sask.

The City Council (Light & Power Department) has approved the following expenditures: Primary feeding wiring, \$28,600; poles and cross arms, \$9,000; street lighting extension, \$25,000; one 200 kw. motor converter, \$23,000. Street Railway Dept.: Railway extension about 6 miles, \$250,000; feed system, \$11,147; four new double track street cars, \$34,000.

Stephen Twp., Ont.

The Twp. Council proposes to take over and extend the municipal telephone system.

Strathroy, Ont.

The ratepayers voted the sum of \$25,-

000 to change the lighting system to Hydro-electric.

Transcona, Man.

Tenders will be received by P. E. Ryan, Secretary, Transcontinental Railway, Ottawa, Ont., until March 10th, for shavings and sawdust exhaust system to be erected in the car shops plant. Plans with W. J. Press, Mech. Engineer, Ottawa, and H. H. Pinch, Asst. Engineer, Transcona.

Vernon, B.C.

The ratepayers will be asked to vote on by-law authorizing the expenditure of \$11,000 on extensions to the electric lighting system.

Miscellaneous

Calgary, Alta.

Tenders are invited on concrete construction irrigation scheme by the Can. Pacific Railway. Plans, etc., and full information can be obtained from the Chief Engineer, A. S. Dawson, who will receive tenders until noon, March 14th. The work includes the concrete (irrigation) structure in about half the area comprising the eastern section of the company's irrigation block, Alberta. Materials, except for forms, will be furnished by the company. Approximate quantities, 3,800 cu. yds. concrete and 192,000 lbs. reinforcing steel. Quantities in individual structure vary from 15 cu. yds. to 80 cu. yds.

Edmonton, Alta.

A by-law is to be voted on shortly to raise the sum of \$5,500 for tools for the waterworks department.

Edmonton, Alta.

The ratepayers will shortly vote on a by-law to raise the sum of \$5,300 for the erection of cranes.

A by-law is to be submitted to the ratepayers in about two months to raise funds for the purchase of a new combination chemical and hose cart, \$7,400; combination motor hose and pumping engine, \$24,000; motor flying squad wagon, \$7,400; motor repair fire alarm system wagon, \$1,500; horse drawn hose wagon, \$2,000; \$8,000 will be asked to furnish new fire hall; addition to fire alarm system, \$12,411; new service ladder truck, \$7,500; nozzles, \$350.

Guelph, Ont.

The City Council is considering the purchase of lumber. Further information from the Manager, Street Railway.

London, Ont.

The steam heating of the County of Middlesex Building is under consideration.

London Twp., Ont.

The Twp. Council is about to purchase the supply of cement required to be used in construction of bridges.

Medicine Hat, Alta.

The sum of \$7,000 was included in the estimates for fire equipment and a fire alarm system will be installed this year if funds are available.

Ottawa, Ont.

Tenders are called by the Dominion Govt., Dept. Railways and Canals, Deputy Minister, L. K. Jones, until February 26th for supply of 185,000 barrels of

(Continued on page 82)

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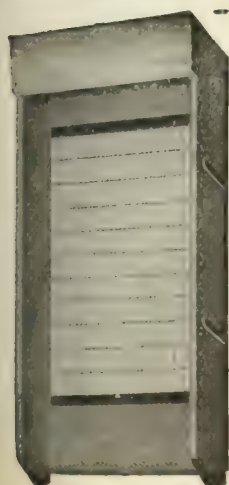
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cement. Specifications are at the office of the Purchasing Agent.

Moncton, N.B.

St. John's Presbyterian Church has been destroyed by fire, \$22,500 of the \$30,000 loss was covered by insurance.

Oshawa, Ont.

The residence of R. S. McLaughlin, president McLaughlin Motor Car Co., was damaged by fire to the extent of \$10,000; the loss was covered by insurance.

Ottawa, Ont.

The sums of \$9,000 and \$25,000 for elevators for the post office and Langevin Block, were included in the estimates for 1911.

The sum of \$85,000 was included in the estimates for improvements to grounds, purchase of furniture, etc., at Rideau Hall.

Richmond, Que.

Tenders will be received by Secretary, E. F. Cleveland, until Feb. 28th, for the supply and installation of a heating system for the municipal building.

Saskatoon, Sask.

Mayor T. E. Harrison will receive tenders until March 10th for the supply of 12 tons class A cast iron pipe, 12-in., 65 tons class B cast iron pipe 12 to 24 in., 13 tons class B specials, 12 to 24 in., 9 gate valves 12 to 20 in. Full information from the Engineer, Junius Jonsson.

St. Thomas, Ont.

Tenders will be received by City Engineer, M. Ferguson, until 5 p.m., Mar. 2nd, for approximately 25 fire hydrants. Full information may be had at the office of the engineer.

Thamesford, Ont.

Mercer Bros. have decided to install hydro power, milking machines and general farm hydro equipment.

Toronto, Ont.

Four Auto Trucks, \$24,000.
The estimates of the Street Cleaning Department include the sum of \$24,000 for four auto-trucks.

Windsor, Ont.

The fire committee contemplates purchasing hose, signal boxes, etc., in addition to the aerial truck, tractor and ladder truck recommended by Fire Chief Murray.

CONTRACTS AWARDED

Ottawa, Ont.

The Ottawa Gas Co., Sparks St., have awarded contracts as follows: General contract, masonry and carpentry, Stuart & Sutherland, Lees Ave.; steel, Dominion Bridge Co. and International Marine Signal Co.; gas holders, Camden Iron Works, New Jersey; condensers, apparatus, etc., I. Porter, Newark, N.J.; the following parts of the works have not yet been commenced: Offices, coal sheds etc., and about three-quarters of the apparatus is to be placed. The work will probably not be completed until late in the year.

New Companies

The Cedars Construction Co., Ltd., has been incorporated with a capital of \$50,000, with head office at Montreal, to carry on business as general contractors.

The provisional directors are E. S. McDougall, F. G. Bush, H. W. Jackson, G. R. Drennan, and M. J. O'Brien, all of Montreal.

William Bradley & Son, Canadian, Limited, has been incorporated with a capital of \$10,000, with head office at Toronto, to carry on business as marble and stone merchants, etc. The provisional directors are W. A. J. Case, H. E. Wallace, J. B. Taylor and C. G. Lynch, all of Toronto.

J. A. Major, Limited, has been incorporated with a capital of \$50,000, with head office at Montreal, to carry on business as general contractors. The provisional directors are A. Marchand, J. A. Guitard, B. C. Bellew and H. M. G. Bellew, all of Montreal.

J. S. Penny, Limited, has been incorporated with a capital of \$25,000, with head office at Vancouver, B.C., to carry on business as general contractors.

General Electric Contracting Company, Ltd., has been incorporated with a capital of \$10,000, with head office at Vancouver, B.C., to take over the business of the General Electric Contracting Company as a going concern.

The Bertrand Lockhart Lumber Co., Ltd., has been incorporated with a capital of \$75,000, with head office at Port Arthur, Ont. The provisional directors are A. G. Seaman, H. A. McKibbin, J. H. McLennan, W. Marrigan and J. P. Bertrand, all of Port Arthur.

The Edgewood Sand and Gravel Co., Ltd., has been incorporated with a capital of \$100,000, with head office at Winnipeg. The provisional directors are J. W. Frid, H. D. Mewhirter, J. E. Robertson, W. H. Carter and A. B. Ellis, all of Winnipeg.

Business Notes

Banff, Alta.

A recent fire destroyed the King Edward Hotel, involving a loss of about \$50,000.

Cobalt, Ont.

The residence of Andrew Westburg was recently destroyed by fire. Loss \$7,000.

Calgary, Alta.

The shoe store of E. M. Foster, 240 8th Ave. W., has been destroyed by fire. The loss to building and stock is \$30,000.

Camrose, Alta.

Three stores on Main St. occupied by Geo. Wells, gents' furnishings; A. Caruthers, general store, and W. G. Duggan, hardware store, have been destroyed by fire. The total loss is estimated at \$20,000.

Francis, Sask.

A bad fire on Main Street resulted in the destruction of the Standard Hotel, loss \$30,000, and the drug store of H. M. Woodhull, loss \$7,000.

Hamilton, Ont.

A disastrous fire occurred at R. McKay & Company's building, 55-63 King St. E. The damage is estimated at \$200,000.

Kamouraska, Que.

The R. C. Church here was recently destroyed by fire. The loss was \$50,000, \$35,000 of which was covered by insurance.

000, \$35,000 of which was covered by insurance.

Lachute, Que.

The rope factory of W. Bannerman was damaged by fire to the extent of \$50,000.

Montreal, Que.

A recent fire in the wholesale section of the city resulted in the following losses: Ed. Pollak & Co., 442 St. Paul, loss \$20,000; N. Livinson & Co., 508 St. Paul, loss \$40,000. A. J. Alexander, 504 St. Paul, loss \$35,000.

Ottawa, Ont.

The stores and residences of M. Alder, Rideau Street, have been destroyed by fire, loss \$7,000.

The residence of John Redmond, Manotick Rd., near Ottawa, has been destroyed by fire. Loss \$10,000, partly insured.

Port Colborne, Ont.

The G. T. Ry. tower station of the interlocking system has been destroyed by fire.

Paisley, Ont.

Public and continuation school has been completely destroyed by fire.

Sarnia, Ont.

The coal docks of the Northern Navigation Co. have been destroyed by fire. The premises will be rebuilt and new machinery and equipment will be required.

Toronto, Ont.

The C. P. R. water tank at Agincourt Station, having a capacity of 40,000 gals., has been completely destroyed. Loss \$15,000.

The mattress factory of J. M. Purvis, 2 Don Esplanade, was recently destroyed by fire. Loss \$10,000.

E. H. Harcourt & Co., Wellington and Windsor Bldg., suffered a serious loss by fire estimated at \$25,000, which was, however, covered by insurance.

Vankleek Hill, Ont.

The sash and door factory and sawmill of J. R. McLaurin, Jr., has been completely destroyed. Loss \$8,000, of which \$3,000 is covered by insurance.





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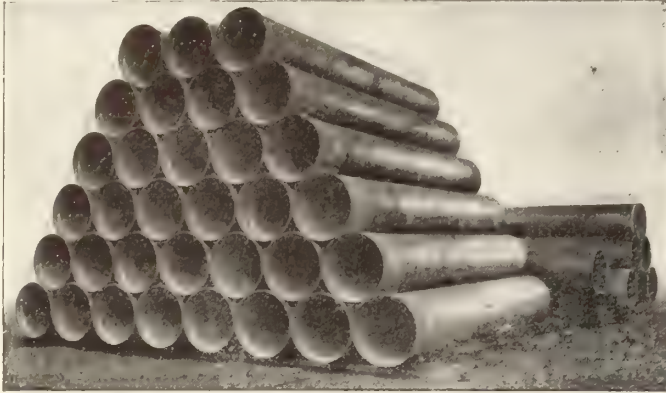
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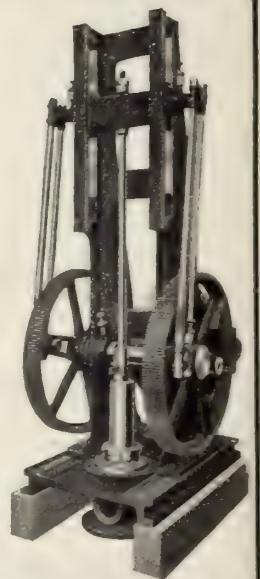
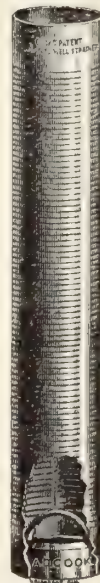
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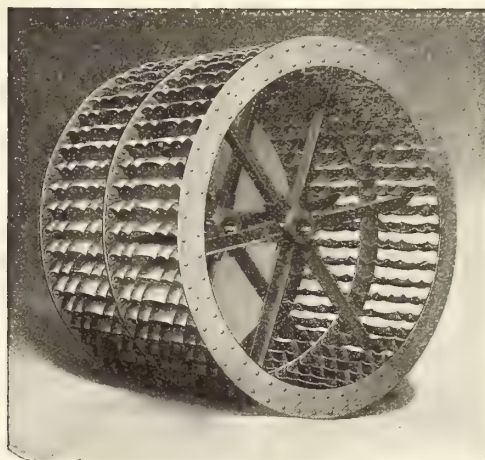
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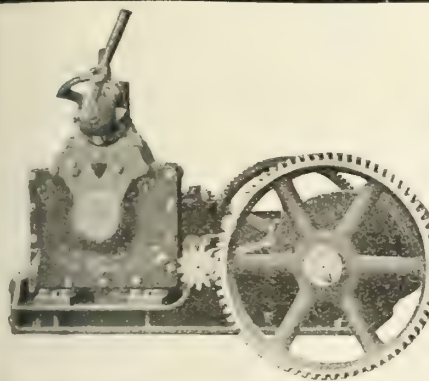
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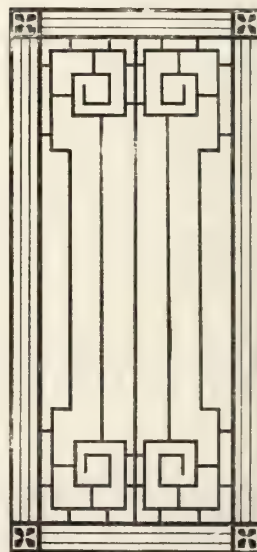
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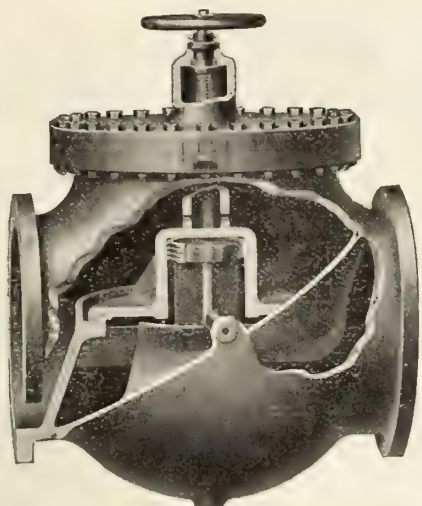
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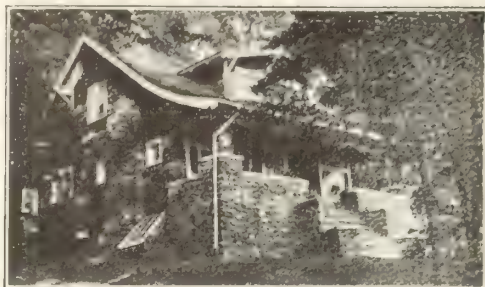
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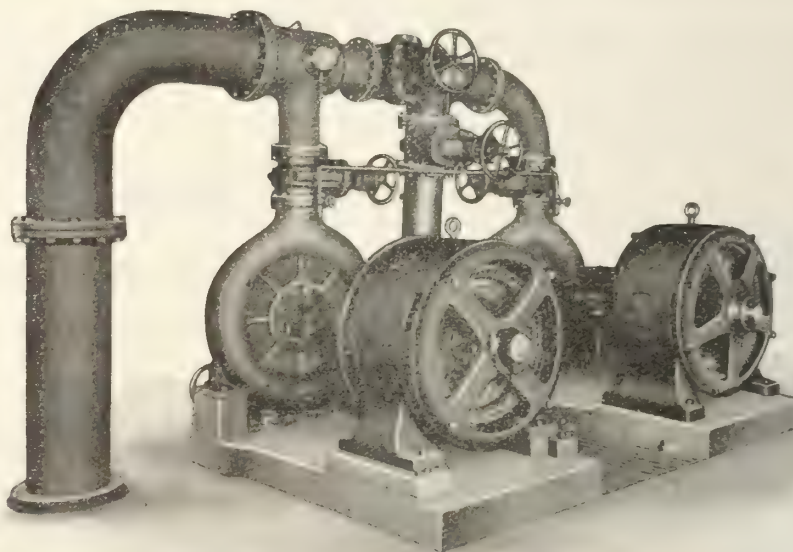
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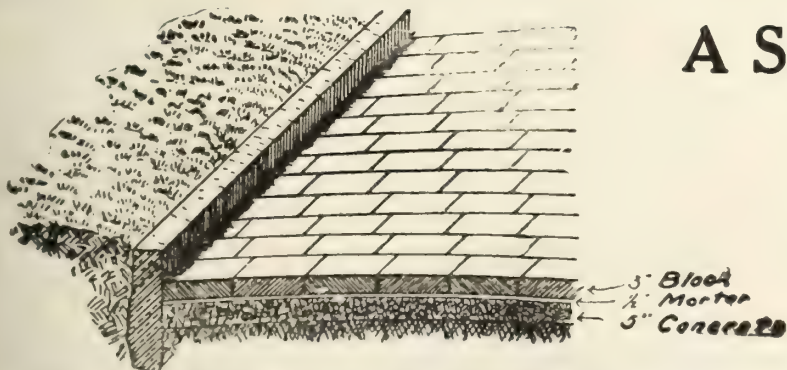
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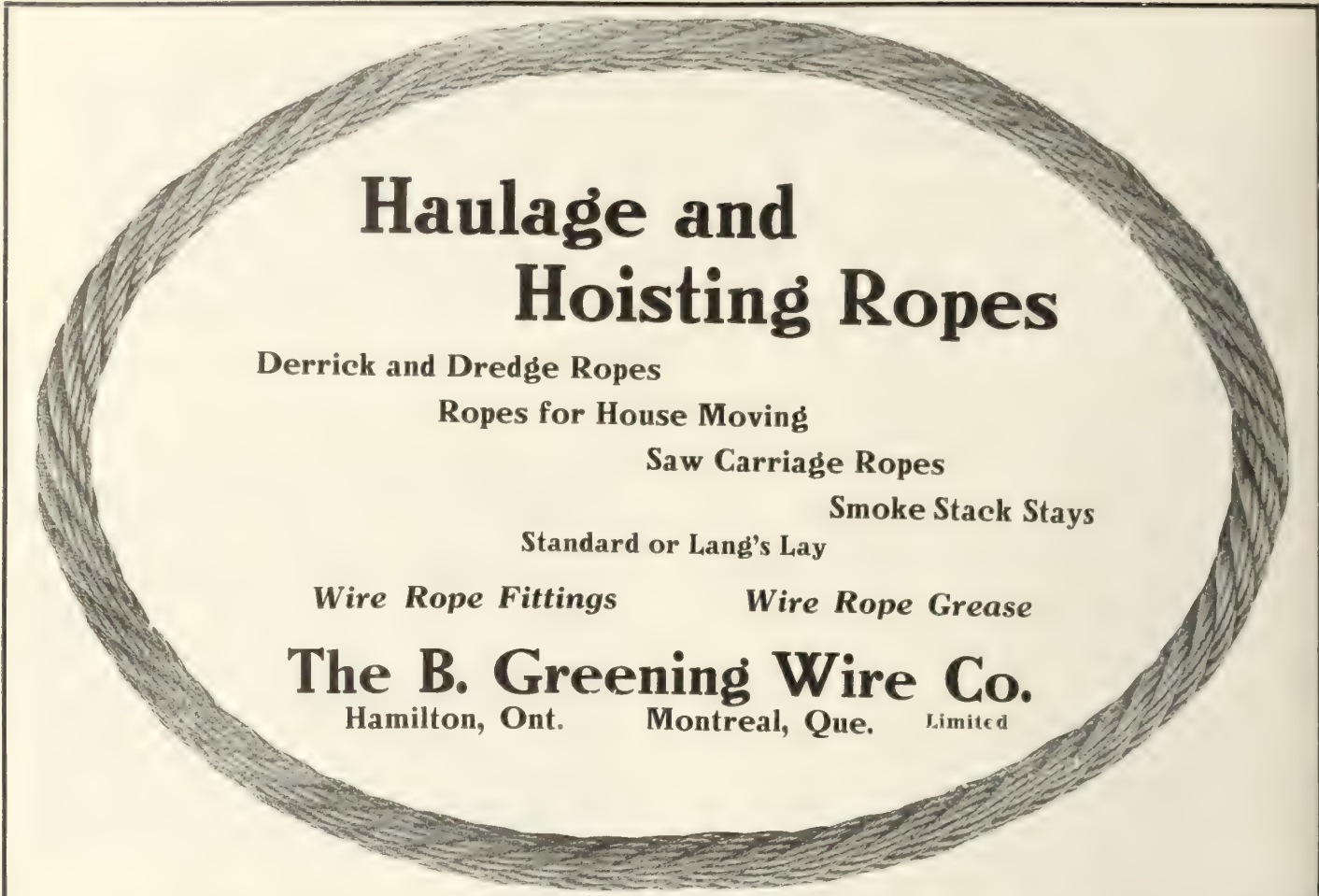
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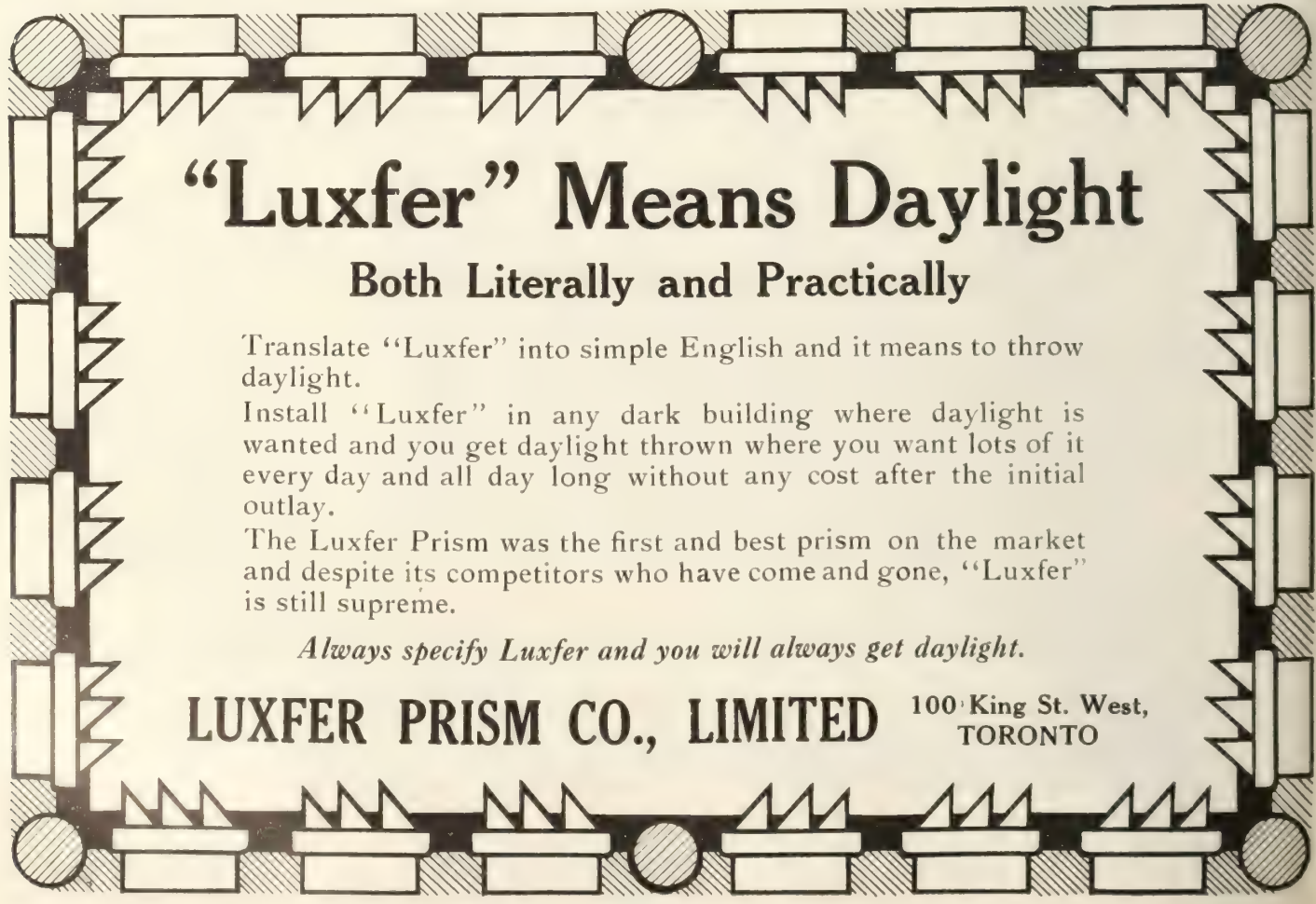
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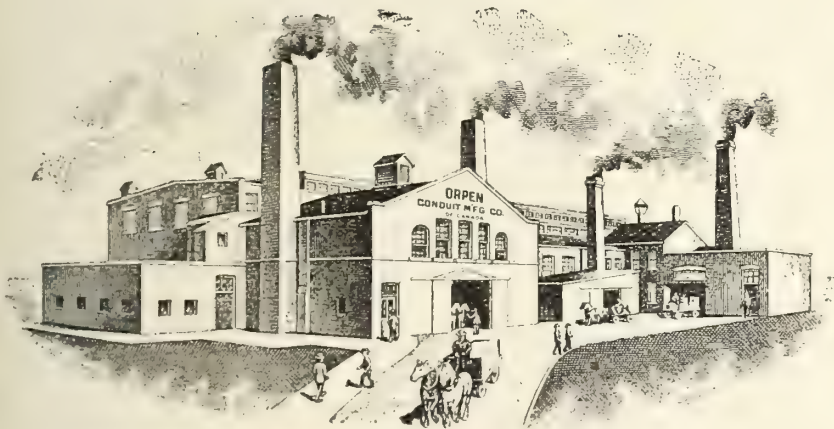
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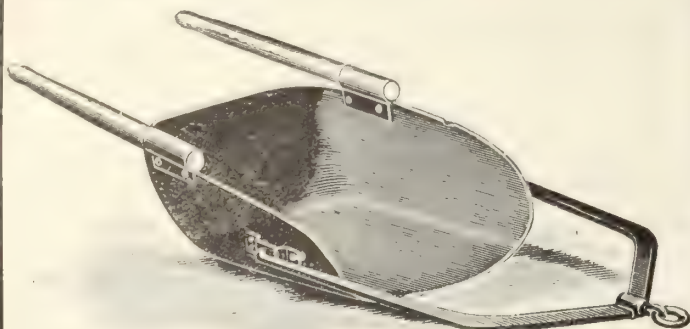
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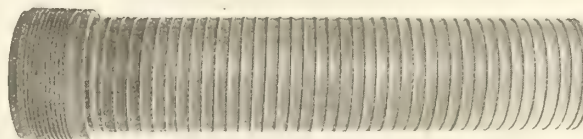
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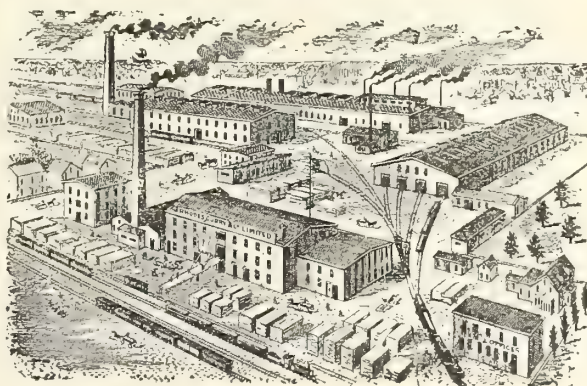
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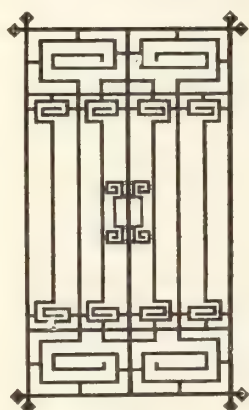
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No. 1 white pine flooring	33 00	
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4 in. casing per 100 ft.	2 00
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8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
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22x22	38 50
12x22	39 00
10x22	39 50

8x22, 14x24, 18x24, 20x24, 22x24, 24x24

24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 15 per cent. for Star and 15 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$ 6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	\$3 25	\$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.s.	\$3 50	\$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 65 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 70 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net \$1.85
No. 4½ Fuller's net \$2.35
Square head brass cocks, 65 and 5 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6¼ cents per lb.; traps and bends, 40 per cent.; pig lead, 6¼ cents per lb.

Size (per 100 ft.)	Black	Galvanized
¾ inch	\$2.16	¾ inch ... \$3.06
¾ "	2.16	¾ " ... 3.06
¾ "	2.64	¾ " ... 3.57
¾ "	3.05	¾ " ... 4.20
1 "	4.51	1 " ... 6.21
1 ¼ "	6.10	1 ¼ " ... 8.40
1 ½ "	7.29	1 ½ " ... 10.04
2 "	9.81	2 " ... 13.51
2 ½ "	16.80	2 ½ " ... 21.65
3 "	20.66	3 " ... 28.31

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 and 10 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in. ... 25c ft.	15-in. ... 1.40 ft.
6-in. ... 40c ft.	18-in. ... 1.90 ft.
9-in. ... 70c ft.	20-in. ... 2.25 ft.
12-in. ... 1.10 ft.	24-in. ... 3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.
Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.
Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; ¾-inch, \$1.45.
Burnt River rubble stone delivered, \$16 to \$17 per toise.
Plain steel bars, \$2.25.
Square twisted bars, ¾ to 1½, \$2.35.
Malleable fittings — Canadian discount, 45 and 42½ per cent.
Free stone delivered, \$15 to \$18 per toise.
Brown coursing stone, delivered, \$3.75 per yard.
Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.
Sand, for cement or brick work, \$1.20 a cubic yard, f.o.b. Toronto, C. P. R. siding.
Sand, for cement or brick work, 85c to \$1.00 a cubic yard, f.o.b. Toronto, G. T. R. sidings.
Brown sills and heads, in the rough, delivered, 40 cents per foot.
Rubble stone in car lots, \$1.30 per ton.
Steel channels and beams, angles and plates, \$2.55 to \$2.90 per 100 pounds, delivered f.o.b. Toronto.
Hard Wall Plaster, unsanded from \$8.00 to \$8.50, bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.
Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.
Plaster of Paris, Anchor and Crown Brands, \$1.50 bbl.
Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, \$8.75 per 100 lbs.
Boiled Linseed Oil in bbls., 65c per gal. of 9 lbs.
Raw Linseed Oil, in bbls., 62c per gallon.
Pure Red Lead, dry, \$7.00 to \$8.00 per 100 lbs.
Putty, pure linseed oil, in bulk, bbls., 3¼c.
Putty, pure linseed oil, in 25-lb. tins, 4c.
Turpentine in bbls., 66c.

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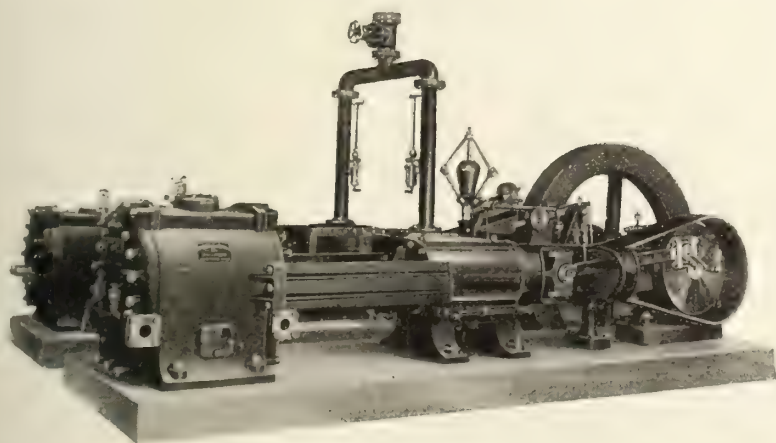
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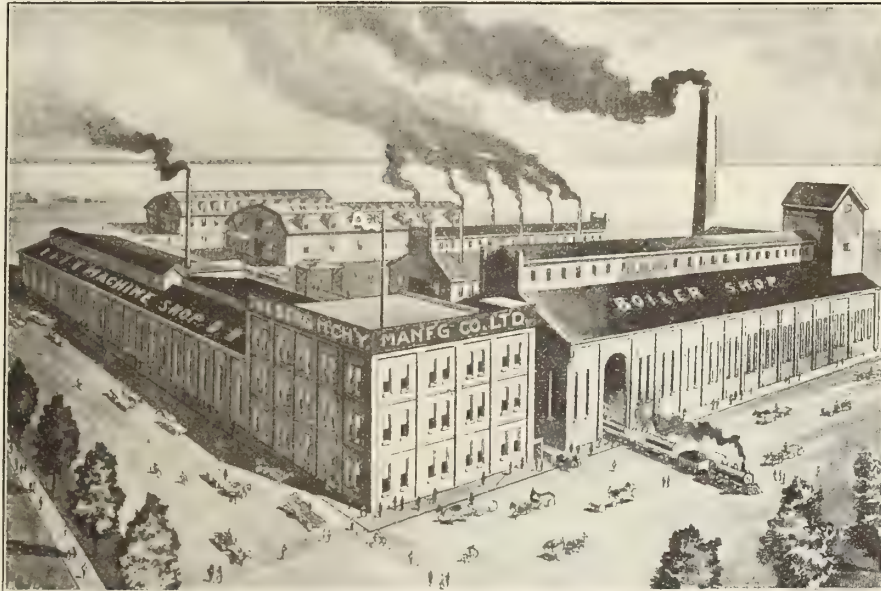
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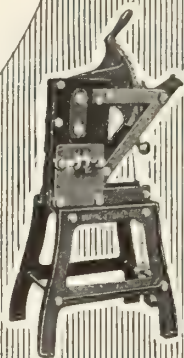
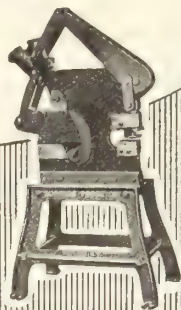
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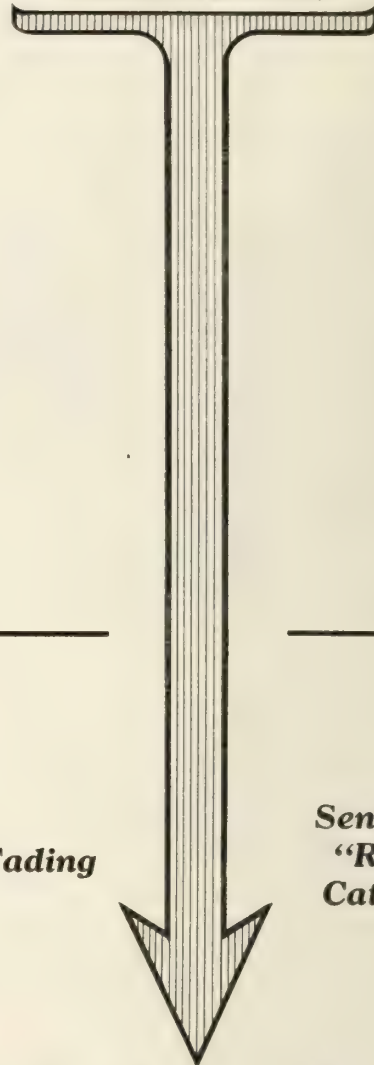
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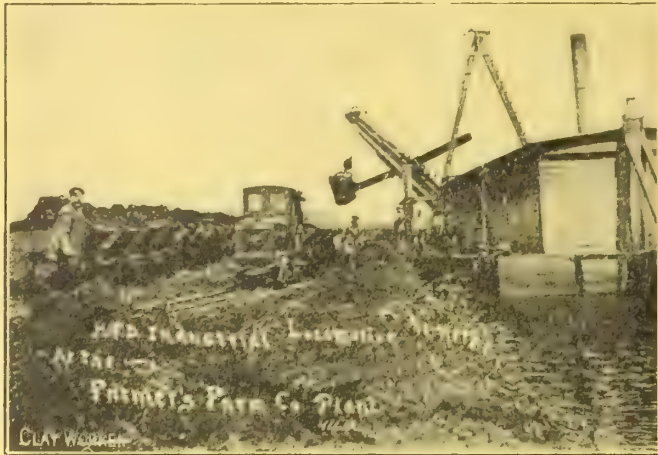
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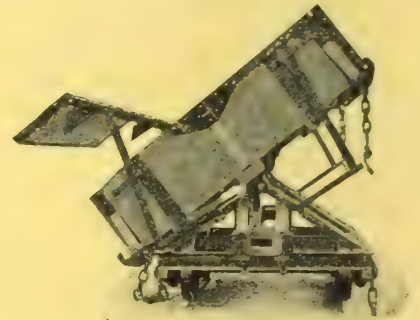
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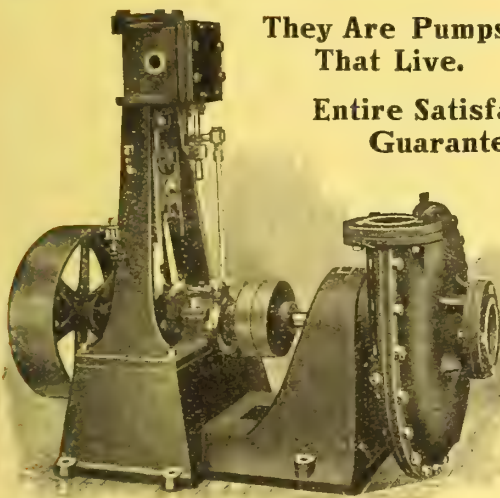
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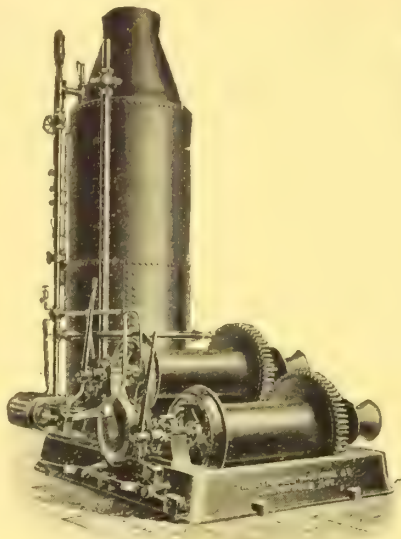
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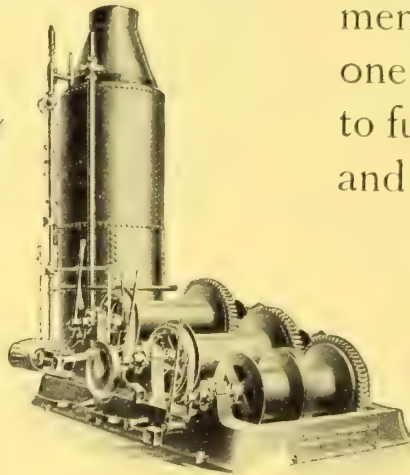


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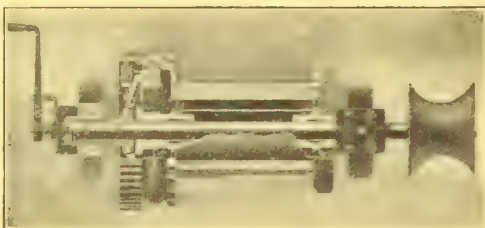
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“AMERICAN” Friction supplements the push of the thrust screw with the toggle action of the friction; this produces a thrust several times greater than the unassisted push of the thrust screw.

An untired operator is bound to get better results than one fagged out by needless tussling with a cumbersome machine.

The cool running “AMERICAN” friction; quick, positive, easy to operate, will save you money. Make us prove it.

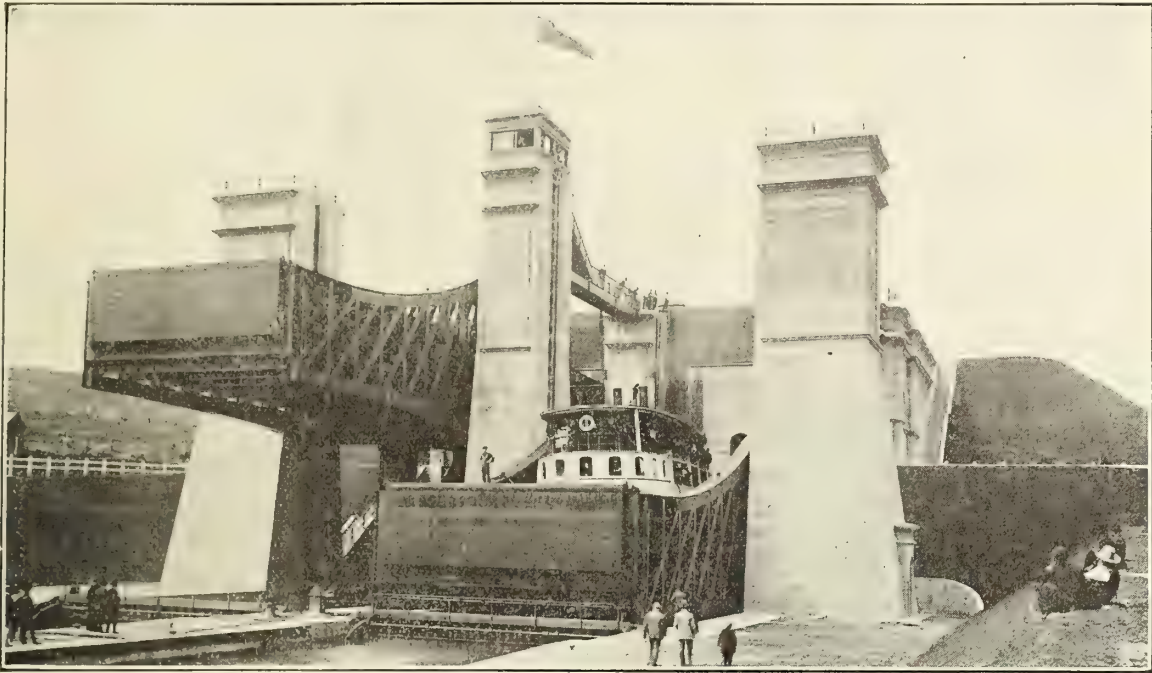
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Means Economy

by reason of the greater portion of the material and labor being obtainable in the district in which a concrete structure is built. This facilitates construction, means convenience to the contractor, and returns most of the cost to the people of the district.

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Wheeling *Forced Feed* Crusher

That's Where It Gets the Name "Forced Feed"

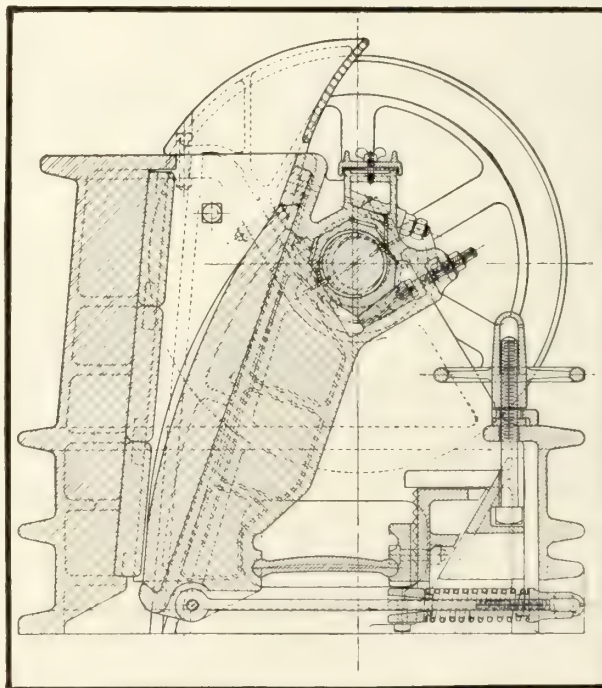
—so you can see right away that we have a right to claim a bigger capacity for our crusher with the same or less horse power.

In a gravel pit most of the material dug from the bank is damp and slippery, sometimes wet and muddy. That's mean stuff to crush. Did you ever see a piece "pop" out of a crusher and fly twenty feet in the air. It is not at all uncommon with the old type crusher. But in a machine like the Wheeling it can't do this. It is dragged into the machine by the same pushing, rolling motion of the movable jaw that crushes it so easily and so fast. It can't clog no matter how wet it is. It just simply has to go through.

Now in a machine with a motion like this gravity doesn't cut much of a figure. In old style crushers the rock drops away from the jaws, but in the **Wheeling Forced Feed Crusher**, it drops away at a rate that makes you wonder how it is done. ***It is forced through and away from the jaws.***

That is the kind of crusher you need in your plant. It can't be broken because its strength is figured on the basis of five times the load it will ever have to crush. You could stall an engine of five times the required horse power before any part would give away. And the chances are that the safety toggle plate behind the movable jaw would be the only thing that would give. That can be replaced in about three minutes time and at a trifling cost.

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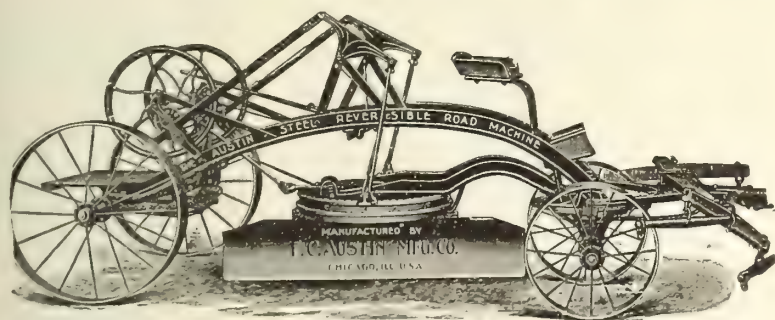
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Mannesmann Tube Co.

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Brewers' Machinery

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(Continued on page 12)

Here, You Folks Interested in Service Boxes, Read What, "Dick" Bell says :

Dick Bell, engineer at the Sarnia Water Works, stopped us and said:

"Say Mueller, I began using that new box of yours last year and have been watching it ever since, and I want to say it sure is a dandy. You know before you fellows brought that fine factory of yours up here, I had been using old style Service Boxes and I had a lot of trouble. The brass screws were stolen and sold for junk, the lids came off and got lost and the boxes filled up with rocks and dirt and I oftentimes had to dig up a box to get at the cock. Then I'd send my men around to plug up the boxes with wooden plugs. We'd take these plugs out with a pick and when we missed the plug we'd break off the top of the box."

"That box of yours simply can't cause these troubles, and they're lots cheaper, too. That lid is on to stay and there's no brass screw to tempt the boys. Any time you want a testimonial just call me up and I'll sure be there. And, say, 'Mueller,' those repair lids of yours have my wooden plug beat a mile. They make those old boxes of mine better than they ever were when new."

Arch
Pattern



22,000

Minneapolis
Pattern



22,002

"Dick" Bell Has it Right—the Mueller Service Box is a Dandy

The Mueller Extension Service Box is the best box on the market, bar none. That's saying a good deal, but it is the truth and you'll admit it when you know the fine points of the box.

The sooner you know these points the better it will be for you. It will mean an end to your Service Box troubles, an end of your repair expense and an end to all the petty annoyances of missing lids, etc. We want you to know this. We want to prove to you what we claim, if you will let us do it. Clip and mail the coupon to-day, and here's what we will do:

"A Generous Offer"

We will send you a Mueller Extension Service Box on trial. It will go forward prepaid and won't cost you one cent if it don't prove all we claim for it.

Sign and send in the coupon. Get acquainted with this great service box.

"Made in Canada"

H. MUELLER MFG. CO., Ltd.

SARNIA, ONTARIO

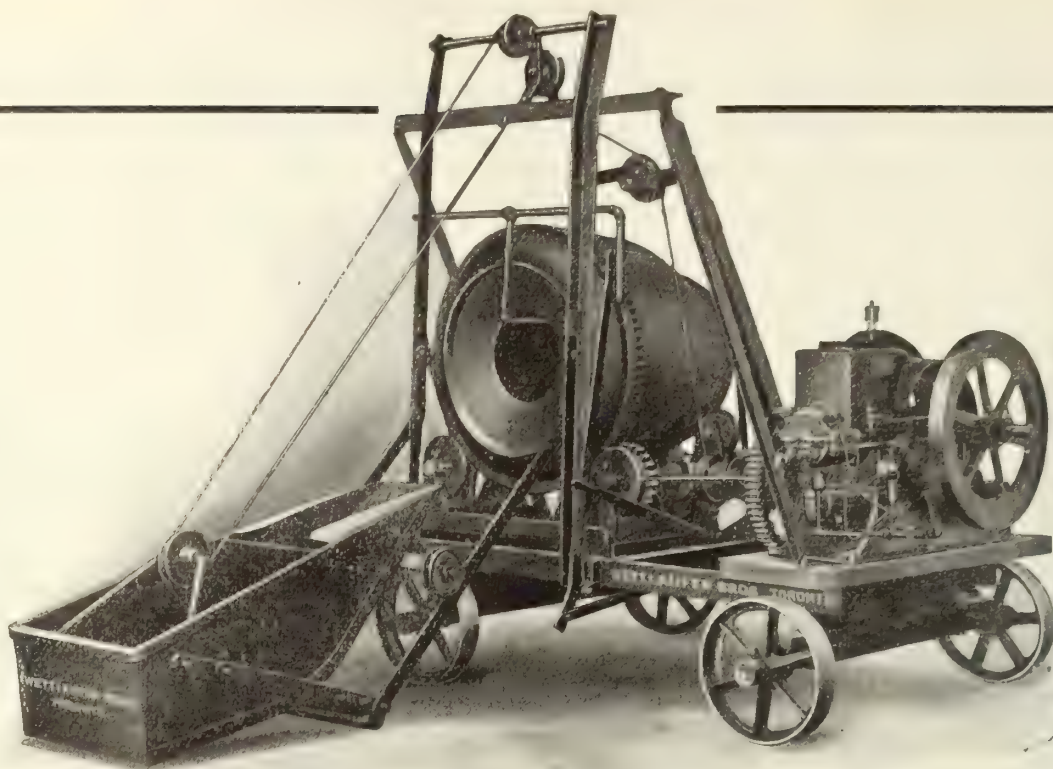
C. R.

H.
MUELLER
MFG. CO.
Limited

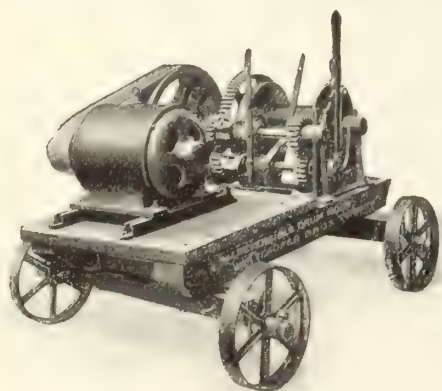
Send me Service
Box on trial in accordance with your offer
herewith.

Signed

City.....Province.....



Mixers and Hoists

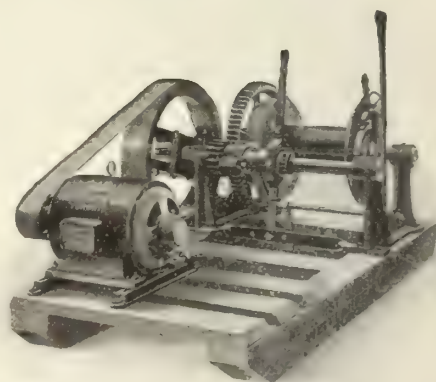


When it is time to buy new equipment be sure and examine the Wettlaufer line or Heart Shape Drum Mixers and Hoists.

Wettlaufer Mixers are famous the country over for their thorough mixing.

Wettlaufer Hoists are made in fourteen different types and sizes.

Attend a daily demonstration at any branch.



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Built for C.P.R. Montreal

Canadian Plant Chicago Bridge & Iron Works, BRIDGEBURG, ONTARIO

Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

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1360 W. 105th St., Chicago, Ill.

SHOPS: Bridgeburg, Ont.
Chicago, Ill.
Greenville, Pa.

The Type O Thew Shovel is Popular for Road and Street Grading 600 Type O Thew Shovels Now Used. Use a Thew—It Pays



Type O Thew on Typical Street Grading

Results on Day Photo was Taken

Lineal feet excavated	418
Width of excavation	20 ft.
Average depth of cut	11 in.
Cubic yards, place measure	280
Teams hauling	3

Results December 15th

Lineal feet excavated	425
Width of excavation	18 ft.
Average depth of cut	20 in.
Cubic yards, place measure	470
Teams hauling	7

Results on Whole Contract

Lineal feet in 23 days	7217
Average depth of excavation	15 in.
Hours per day	8½
Lineal feet per day	314
Cubic yards per day	292
Lineal feet per hour	37
Cubic yards per hour	34

Operating Crew—An engineer and Fireman on the shovel and two laborers on the ground.

Catalogue and Full information for the asking

The Thew Automatic Shovel Company, - Lorain, Ohio

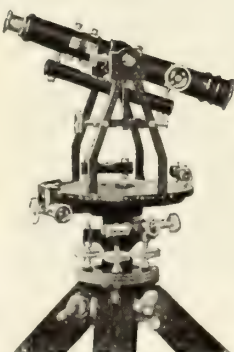
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The ideal instrument for Architects and Builders to use in establishing lines and grades quickly and accurately.

Like all GURLEY Engineering Instruments, it is warranted to satisfy, and is constructed to live up to the guarantee.

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Local Agents Wanted in

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Water Filters Refrigerating Machinery
1,000 to 1,000,000 Gallons a Day 1/4 to 60 Ton Daily Capacity
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4 Gallons to 5,000 Gallons a Day

Refrigerators and Refrigerating Boxes for Ice or
Machine Refrigeration
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EQUIPMENT & SUPPLIES, LIMITED
302 MCGILL BLDG., MONTREAL, P. Q.

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High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

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OUR BRICK SHOWROOM IN MAIL BUILDING

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in Mind when Ordering
High Grade Brick.

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Columbus Brick and
Terra Cotta Co.

Hydraulic-Press Brick
Co.

Hocking Valley Fire
Clay Co.

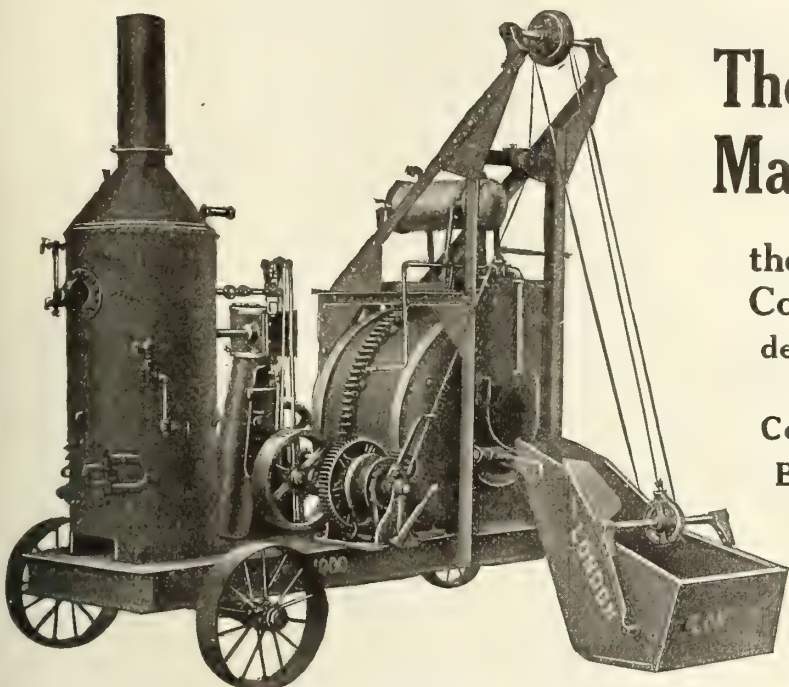
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Co.

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Brick Co.

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London Standard Drum Batch Mixer
This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

The London Concrete Machinery Co., Limited

the Largest Manufacturers of
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desire to quote prices to intending
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Herringbone Metal Lath



is constructed like a miniature floor.
The joists are the ribs and the floor-
ing is the cross filament.

No one ever thinks of building
a floor without joists. Every think-
ing man realizes that if he replaces ordinary metal lath with
Herringbone Ribbed Lath, he will get superior construction.

Clarence W. Noble,

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General Sales Agent

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The Metal Shingle & Siding Company, Manufacturers

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(Continued on Page 14)

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THE smallest amount of current on the heaviest load is accurately measured on a Ferranti meter. Our meters are guaranteed for three years against all mechanical or electrical defects.

Ferranti meters are assembled and thoroughly tested at our Toronto or Winnipeg warehouses where a large stock is always on hand.

Illustration shows our improved type "C" meter, single or polyphase; top or bottom connections; clock or cyclometer dials.

A postal card will bring complete particulars on Ferranti meters.

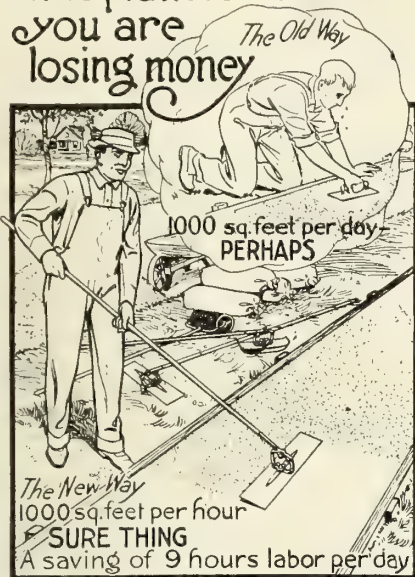
The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

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If you are not using
"ABRAM"
TOOLS

It is plain to be seen
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Abram Cement Tool Co.,
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1877

37 Years of Rapid Progress

THE Western Wheeled Scraper Company was inaugurated in 1877. With wheeled scrapers as the first manufacture, the line has been increased from time to time, until now it comprises almost every kind of earth and stone handling machinery.

The constant aim of this company has been to produce the best possible goods in this particular line of manufacture, and the increasing demand for Western products is ample proof of their superiority.

Write us today for catalog

Western Wheeled Scraper Co.

AURORA, ILLINOIS

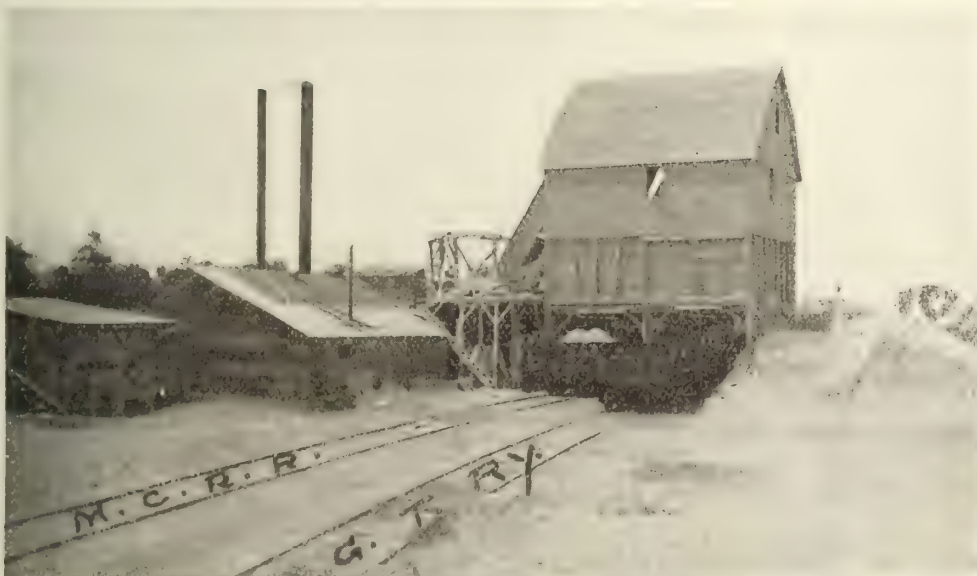
Earth and Stone Handling Machinery

Dominion Equipment & Supply Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta

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1 9 1 4

Macadam Roads



*must be built
 of a*

Tough Stone

*that
 will cement*

WE HAVE IT

The Hagersville Contracting Company, Limited
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(Continued on page 16)

What Big Contractors

Say About This Koppel Car

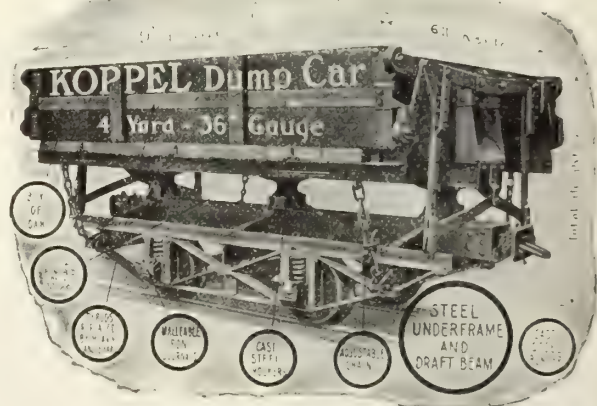
Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

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DUNDAS, ONTARIO

Canada
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Ltd.

Dear Sirs
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das Stone.

Name

Address

Occupation

NOTE THE PERPENDICULAR POSITION OF THE Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

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First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

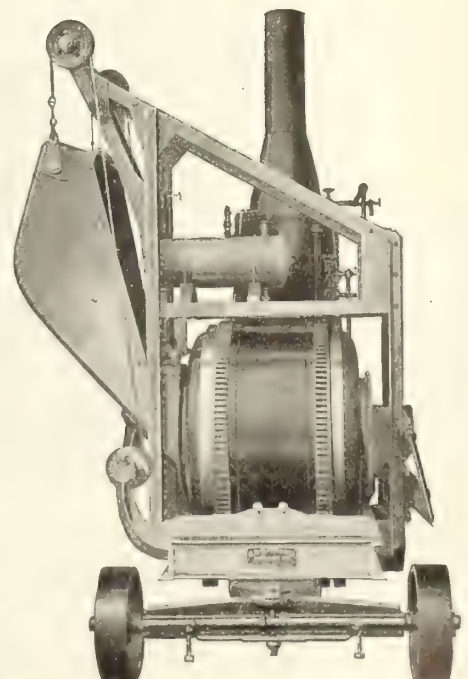
All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

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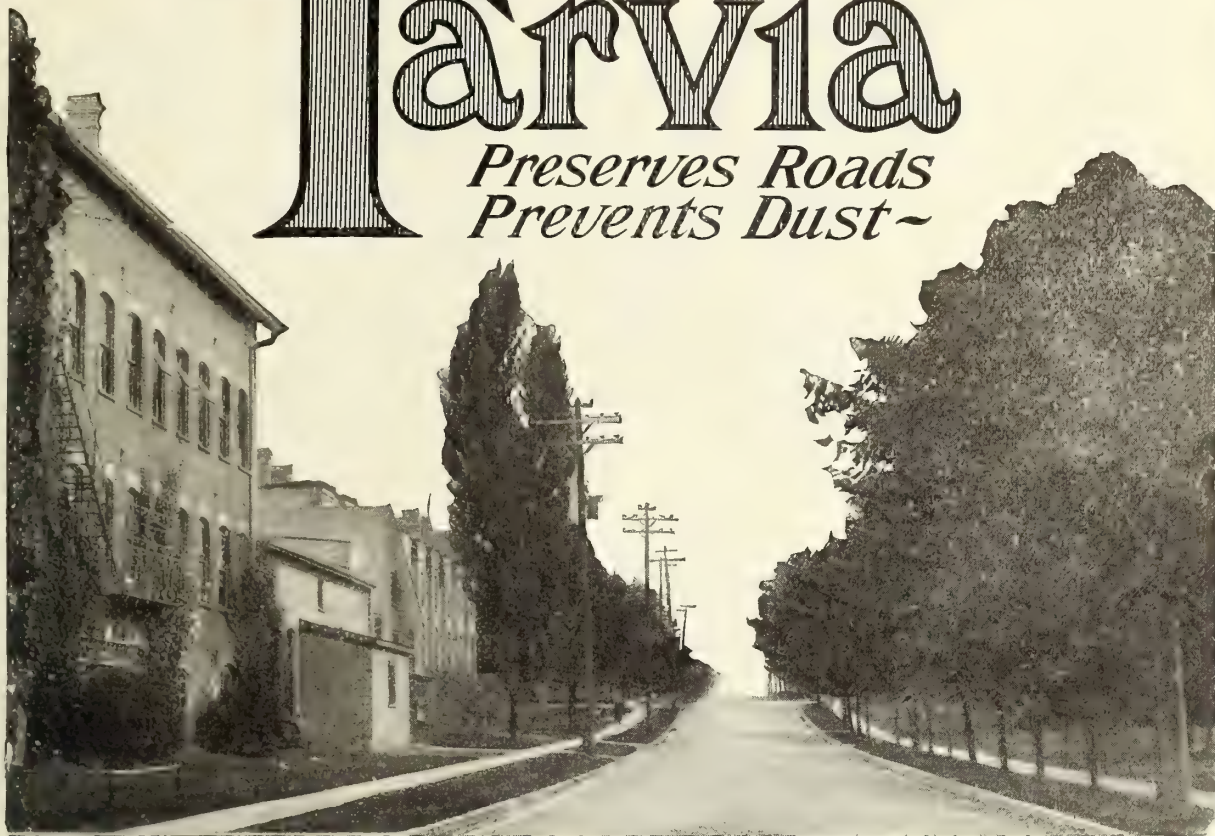
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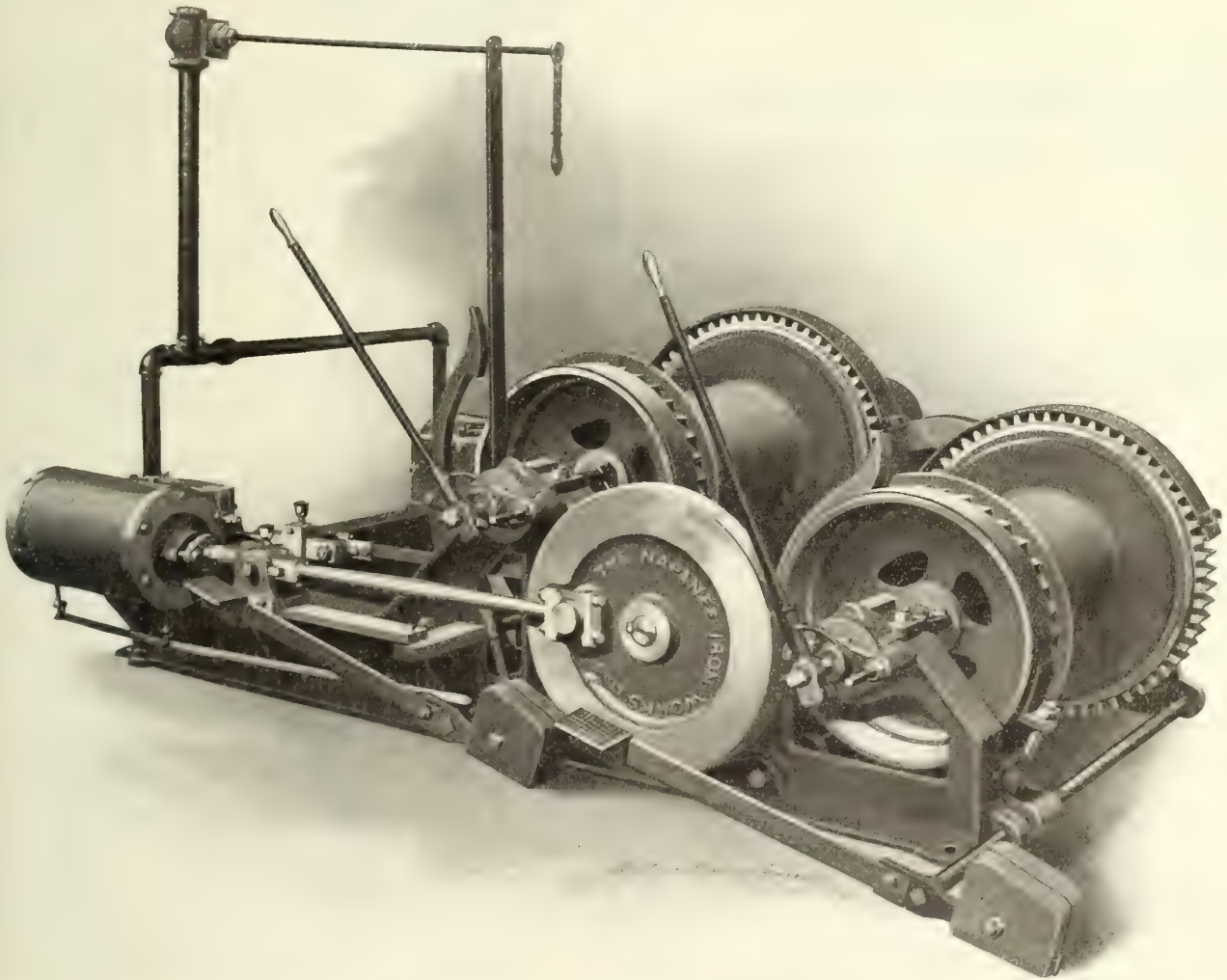
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Vitrified Hollow Building Blocks

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ROUND PIPE AND SQUARE DEALINGS

will you line your fire-place with wood? Will you use iron or soft pressed-brick? Certainly not. You will want the very best high-grade Fire Brick for that job. Why? Because fire will destroy anything else.

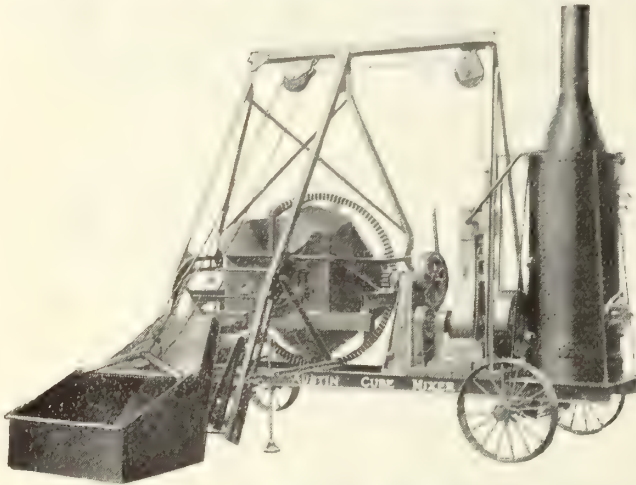
If old Mother Earth could have been destroyed by the acids and gases and alkalies and what-not contained therein, it would have gone up in smoke long ago, so, what more effective article could you get to withstand these deadly workers than Earth—just earth—shaped and burned to fusion point then glazed. The strong acids of a Sewer or even the surrounding soil, in many cases, soon destroy cement work, iron work or steel, but clay, which cannot be destroyed, stands for all time.

As well build your fire-place of hardwood as your Sewer of any other material but clay—Vitrified Saltglazed clay—Sewer Pipe.

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Smooth, Creamy Concrete Comes from Moderate Wetting and Thorough Mixing

The Austin Improved Cube Mixer is a thorough mixer because it mixes by **kneading**—incorporation under pressure—and not by dipping and plowing, as do all other drum mixers. It mixes rapidly because, every mixing motion affects the whole batch and not a fraction of the batch, as do paddles and plows.

Austin Cube Mixer Concrete Has Superior Chuting Quality

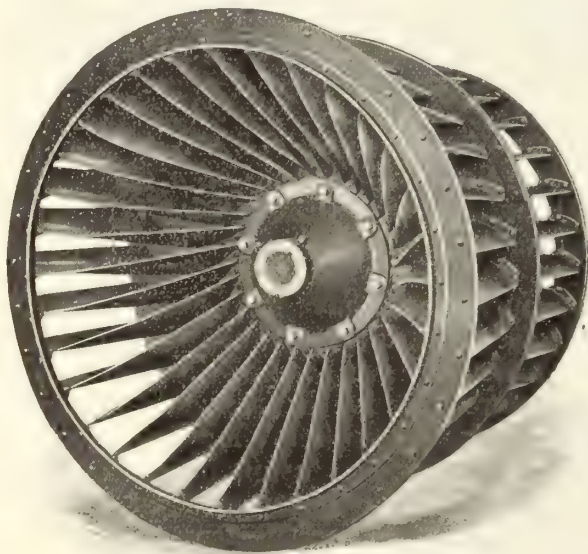
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GALT, ONTARIO
609 KENT BUILDING

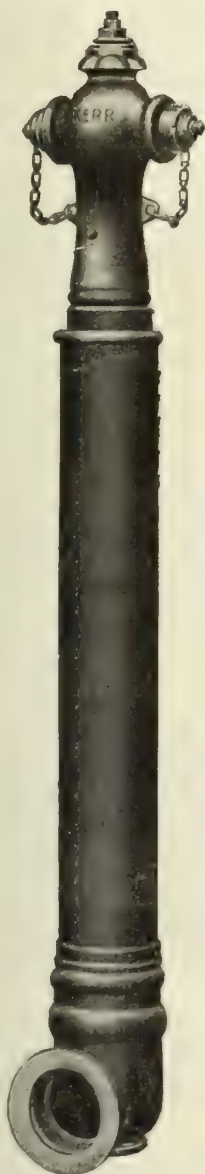
AGENTS:

Messrs. ROSS & GREIG, 412 St. James St., Montreal, Que. Messrs. WALKER'S LTD., 259 Stanley St., Winnipeg, Man.
Messrs. GORMAN, CLANCEY & GRINDLEY, Ltd., Calgary and Edmonton, Alta.
Messrs. ROBERT HAMILTON & CO., Ltd., Bank of Ottawa Bldg., Vancouver B.C.

KERR

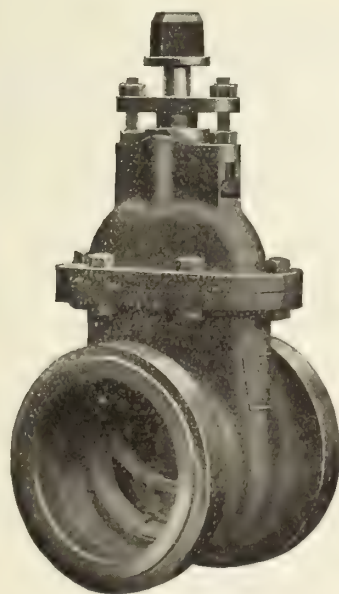
Hydrants and Gate Valves

are made with Hub for Cast Iron, Wood or Steel pipe spigots. They have full area of water-way, and are strong, compact and modern in design and construction.



Standard Compression Hydrant

*Send us your
Specifications
and Enquiries.
Prompt attention
given.*



6" Hubbed

THE **KERR ENGINE CO.**
LIMITED
WALKERVILLE, ONT.



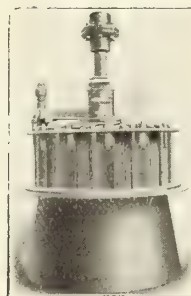
Everything in TANKS

SPRINKLER
TANKS
RAILROAD
TANKS
SUBURBAN
TANKS
PRESSURE
TANKS
STEEL
SUBSTRUCTURES
WATER SUPPLY
OUTFITS
GASOLINE
ENGINES
WIND MILLS
GRINDERS
SAW FRAMES
SAWS, ETC.

Ontario Wind Engine & Pump Co.

Limited

Toronto Winnipeg Calgary Montreal



Water Wheels

The Samson wheel in official independent tests has shown very high efficiencies—reaching practically 90% (89.99). This is a guarantee that under your conditions our wheel will develop all the power possible, and give you results that cannot be surpassed by any wheel.

It is easy to install and to control when in operation and the workmanship, materials and performance are fully guaranteed.

Shall we send you our catalogue.

William Hamilton Company
Peterborough, Ontario

J.O.B. CONTRACTORS PUMPS

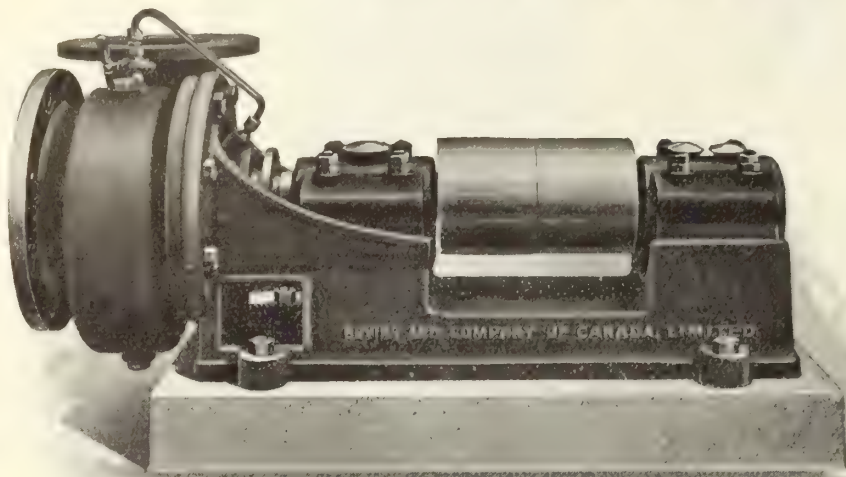


Illustration shows 10" Contractors Pump.

Belt Driven Low Pressure
Pumps of Solid and Durable
Design — Built for Heavy
Duty.

*Let Us Quote on
Your Requirements*

Pumps for all purposes
Belt Driven
Direct Connected
High, Medium and
Low Pressure

Boving & Co. of Canada Limited

Head Office: 164 Bay St., TORONTO

MOOSE JAW: 13 Hochelaga St.

Works: LINDSAY, ONTARIO

VANCOUVER: Room 804 London Bldg.

No. 232

TOCH BROS. "R. I. W." EST. 1848

REMEMBER IT'S WATERPROOF

R. I. W.

DAMP RESISTING PAINT

MANUFACTURED IN CANADA

INSULATES
CHECKS DAMPNESS
BONDS PLASTER TO BRICKWORK
SAVES COST OF FURRING

Write for
Edition of "Red Book"

R. I. W. DAMP RESISTING PAINT CO., TORONTO.

Office: 202 MAIL BUILDING, TORONTO

(TOCH BROS.)

Factory: OAKVILLE, ONT.

Black Building Supply Co., Limited, Toronto

Dartnell Limited, Montreal

Gandy & Allinson, St. John, N.B.

A. R. Pruneau, Quebec

Lawrence Hardware Co., Limited, Halifax, N.S.

—DISTRIBUTORS—

Western Paint Co., Winnipeg

Carter, Dewar, Crowe Co., Vancouver

People's Building Supply Co., Fort William

Can. Equipment & Supply Co., Ltd.,

Calgary and Edmonton

COPPER BEARING, RUST RESISTING SHEETS BLACK AND GALVANIZED

Specially Adapted for All Exposed Sheet Metal Work
Send for DESCRIPTIVE BOOKLET, SAMPLES and PRICES

UNITED STATES STEEL PRODUCTS COMPANY
NEW YORK, U. S. A.

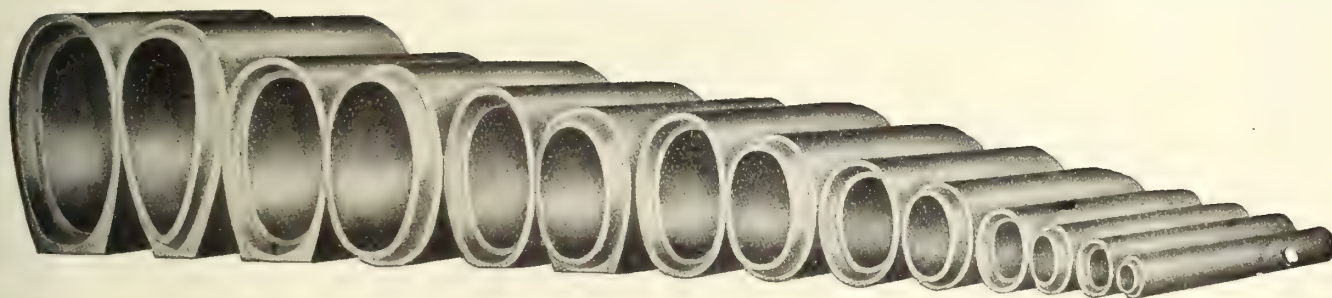
Branch Offices: Winnipeg and Vancouver

SELLING AGENTS FOR EASTERN CANADA:

B. & S. H. THOMPSON & CO., Limited

Transportation Building, MONTREAL.

Traders' Bank Building, TORONTO



Sewers and Culverts

properly built of properly made

- Reinforced Concrete Pipe -

LAST FOREVER.

OUR MATERIAL, SYSTEM and PRODUCT have been tested and approved by EMINENT ENGINEERS.
NO RUST, NO ROT, NO FROST-BREAKS, NO PRESSURE-BREAKS, NO HIGH PRICES, NO
DELAYS IN PROCURING, NO TROUBLE IN HANDLING.

STANDARD REINFORCEMENT, or SPECIAL if required. Stock sizes 6 in. to 60 in.

Patronize Experienced and Reputable Manufacturers.

Catalogue and prices on application.

Dominion Concrete Company Ltd.

Kemptville, Ontario

Hy-tex Hy-tex Hy-tex Hy-tex Hy-tex



Spreatt & Rolph
Architects, Toronto

House for Nurses
Woodstock General Hospital
Woodstock, Ontario

Faced with
Hy-tex Bokhara Brick

There is one name by which you can identify QUALITY in every kind and style of the most desirable material for outside walls. It is

Hy-tex Brick

You want a brick you can identify—the maker's name makes him directly responsible to you. And Hy-tex is the only name which stands for universal quality in brick—and for that only.

All other brick trade-marks mean some one color or some one texture. The Hy-tex trade-mark means simply best brick. And there's a Hy-tex brick in every color and every texture known to brick-burning.

*Somewhere in the Hy-tex line
there is just the Brick you want.*

HYDRAULIC-PRESS BRICK CO.

AGENTS IN EASTERN CANADA

Alex. Bremner, Limited
Bleury Street, Montreal
Pruneau & Cie
140 Rue St. Pierre, Quebec

Black Building Supply Company
Mail Building, Toronto
W. A. Freeman Co., Limited
Hamilton, Ontario

Hy-tex Hy-tex Hy-tex Hy-tex Hy-tex

USE INQUIRY FORM IN LOWER CORNER.

Cutting Out the Dead Expense In Selling.

In addition to the plans you have already made, or have in preparation, for securing a larger share of business during the coming months, have you included a daily report service?

Though your arrangements are so complete that you will be able to locate even a majority of the prospects before tenders are called or contracts are let MacLean Daily Reports will be worth all they cost as a **POSITIVE CHECK** on the efficiency of your sources of information.

The dead expense in selling is the cost of searching out possible customers. And the number of blind leads you follow up to get one prospect, not only adds to the dead loss of selling but uses up the vital enthusiasm of your salesmen and cumbers the routine clerical work in your office.

MacLean Daily Reports give you the very earliest possible knowledge of opportunities for securing contracts or making sales. Every morning you can find on your desk a readily available mass of information selected to your special requirements—specifications, estimates of cost, names and addresses of the owners and designers of every project, whether merely being contemplated or already under course of construction.

Our plan is most certain to open up new possibilities in the way of profitable business. It will increase the value of your salesmen by decreasing the time spent in locating new prospects. It reduces the percentage of wasted time and lost orders by enabling you to concentrate on the most likely opportunities.

LET THE "PROPOSAL OF SERVICE" HELP YOU TO DECIDE.

SENT BY MAIL ON RECEIPT OF REQUEST.

Application for the Proposal.

MacLean Daily Reports, Limited,
220 King St. West, Toronto, Can.

Send me by mail your "Proposal of Service" showing in detail how your reports will assist us in extending our business in Canada. Quote rates for the following provinces. (Check X those in which you are interested). B.C. Alta. Sask. Man. Ont. Que. Maritime.

Name

Address.....

Attach this Coupon to your business letterhead and mail.

MacLean Reports are issued daily (card system) and give accurate information on CANADIAN building and engineering projects, contemplated, their progress, and details of the material and equipment required. Our plan and system cannot be described in a few paragraphs nor in a single advertisement. We have therefore prepared a **PROPOSAL OF SERVICE** which will enable you to learn as much as you need to know in case you subscribe.

AZTEC ASPHALT

Refined by U. S. Asphalt Refining Co., New York



Swetland Avenue, Scranton, Pa.

100° In the Shade or 40 Below

Tests in laboratory and tests in hard service on the road have proved **Aztec Asphalt** to be the best for Canadian Roadways. The extremes of heat and cold in Canada have no injurious effect on **Aztec**—it remains firm in Summer and does not become brittle in Winter even when buried under ice and snow for a long period.

Other asphalts that are entirely successful in South America, Mexico, Europe or in central or southern parts of the United States, might fail in Canada because of the extremes in temperature here.

For Canada asphalt must not only be pure (nearly 100 per cent. bitumen) but the bitumen must retain its tenacity at all temperatures. In this regard **Aztec** excels. It is impervious to water, has great coherence, resisting wave tendencies.

Aztec is refined by the U. S. Asphalt Refining Company, New York, from liquid asphalt, or maltha, imported from Vera Cruz (Mexico), the land of the Aztecs. It is the expert North American labor, added to the high character of the Mexican maltha, that accounts for **Aztec's** superior qualities.

Canadian municipal and highway engineers and road contractors should buy **Aztec Asphalt** on account of the qualities possessed by its bitumen. It is not—like other asphalts—merely “over 99 per cent. bitumen.” **Aztec** is over 99 per cent. bitumen of special qualities that make it particularly suitable for Canadian requirements.

Aztec Oil & Asphalt Refining Co., of Canada
137 McGill Street, Montreal

THE JACKHAMER

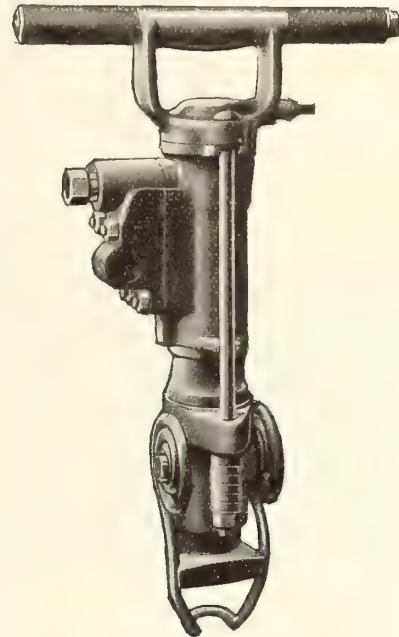
**IS SELF-ROTATING,
SELF-LUBRICATING,
AND IT IS AN ALL-STEEL
DRILL OPERATED BY
STEAM OR AIR.**

In the "JACKHAMER" are those qualities so essential to the low cost of drilling rock.

The all-steel construction with the automatic lubrication protects users against excessive repair costs because the parts are all practically indestructible and are automatically given proper oiling.

As to drilling costs, the "JACKHAMER" has a great advantage over the mounted drills, inasmuch as a wide range of drilling records show that from 40 to 60 per cent. of drilling time with piston machines is consumed in changing holes, setting up, etc.

Whereas, with the "JACKHAMER" from 80 to 95 per cent. of the drilling time is consumed in actual drilling, with the result that the "JACKHAMER" is very materially reducing drilling costs. It is also being universally accepted as an improved method over the heavier machines for work to which it is applicable.



The Jackhamer
used extensively for
sinking and down holes
of moderate depth.

A "JACKHAMER" USER SAYS:

"Just a line re those Plug Drillers we got from you for our Little Rapids Mine. They have been running steadily for the past nine months, drilling in very hard rock most of the time, and up to date have not cost us one cent for repairs, and made it possible to work that Pit to a profit, which I do not think could be done otherwise. Wishing you all the compliments of the season."

*Send for Pamphlet K-68, which
describes the JACKHAMER.*

CANADIAN INGERSOLL-RAND CO., LIMITED.

COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

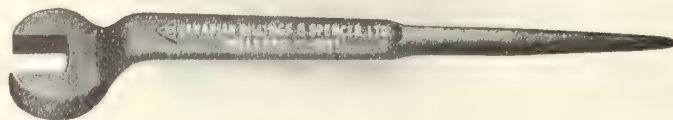
Works: SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

Canadian Billings & Spencer, Limited



TRADE MARK



TRADE MARK

Structural Wrenches—
Drop forged—Standard

Welland, Ontario



STEEL BARS for Reinforcing Concrete

Rounds, Squares, Flats, Twisted Squares

ANGLES— $\frac{3}{4}$ " x $\frac{3}{4}$ " x $\frac{1}{8}$ up to 2" x 2" x $\frac{5}{16}$ ".

CHANNELS— $\frac{3}{4}$ ", - $\frac{7}{8}$ ", - 1", and $1\frac{1}{4}$ ".

T-Bars, Ovals, Half Ovals, Half Rounds, Bands. Cross Arm Braces

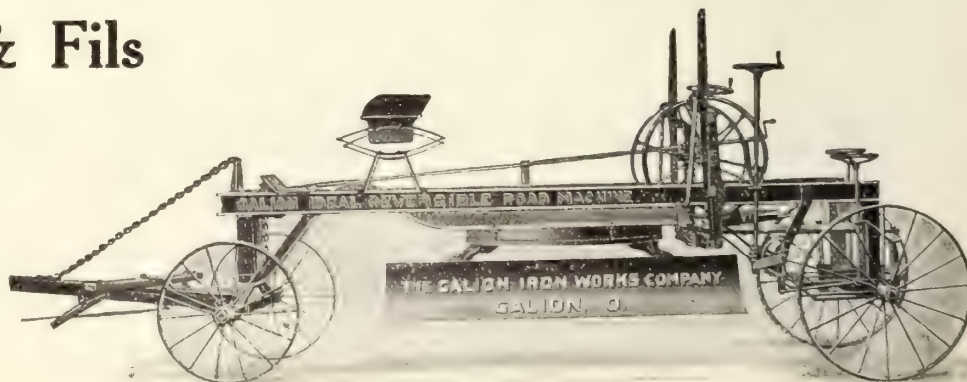
Plain and Galvanized

PROMPT SHIPMENTS

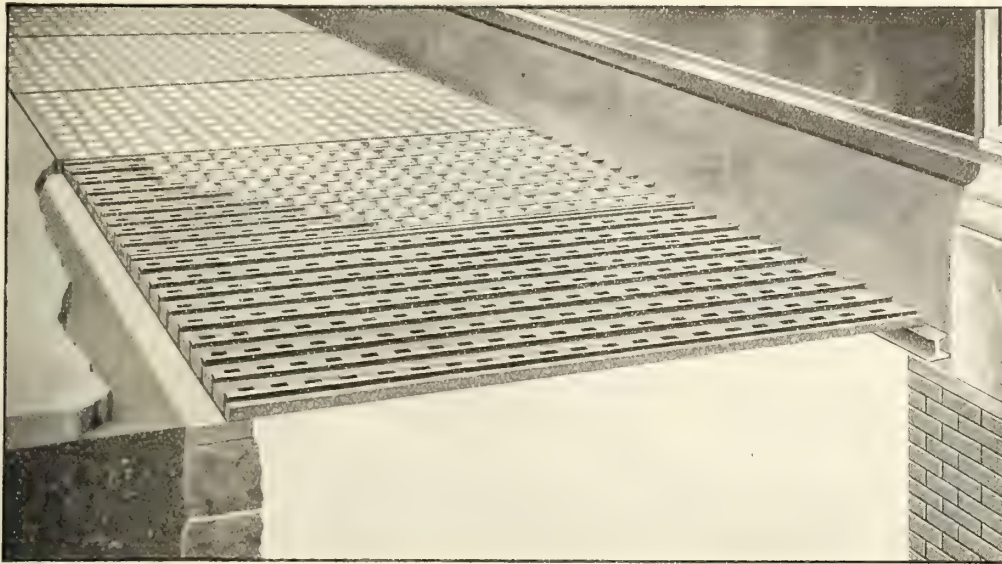
J. B. Dore & Fils

Road Graders, Rock
Crushers, Portable
Engines, Steam Road
Rollers, Sprinklers
etc.

362 Craig St. West, Montreal
and Laprarie, Que.



Simplex Double Reinforced Vault Light Construction



We guarantee this construction to be free from leakage and shaling of the glass.

Sole Canadian Agents and Manufacturers of

**SIMPLEX
NU-PLAN
BAR LOCK
3-WAY
QUICK-SET
SIDEWALK
PRISM CON-
STRUCTION**

HOBBS MANUFACTURING CO., LIMITED
LONDON TORONTO MONTREAL WINNIPEG

Nova Scotia Steel & Coal Company, Ltd.

Beg To Announce

That their new steam-hydraulic forge shop is now in operation, as also is their recently installed "Harmet" fluid compression-plant.

These improvements bring "Scotia's" equipment abreast of the best foreign forges.

They are accordingly open to supply forgings of all shapes and sizes. Made of ordinary or fluid compressed open-hearth steel, and satisfying the most severe specifications.

For Prices and Particulars Apply to

Head Office

-

-

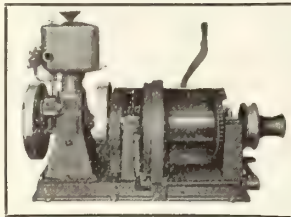
New Glasgow, N. S.

Wanted: 2,500 Contractors

Who have had engine trouble
to read this advertisement
and write for catalog 314.

How Many

times has your engine stopped -- broken down and held up your work?



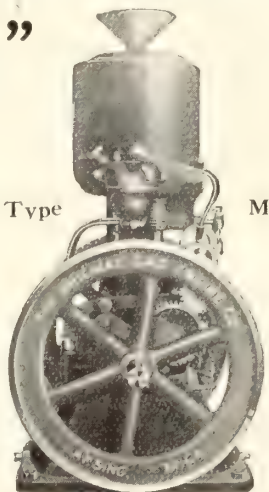
Every time, it's money lost. Can you afford to lose?

Suppose your equipment was driven by an engine which stood for "Constant Service" — "Engine Efficiency" — "Low Operating Cost."

How much would you save? Saving is the biggest feature of the

"Ideal"

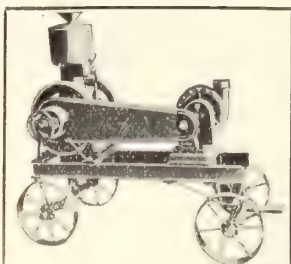
Fool Proof
Frost Proof
Dirt Proof
Enclosed
Crank Case
No Vibration
Large Valves
Self Oiling
Boxes



Get our latest catalog for many other points.

Engines

"The Engine of many features"



Contractors who want "always on the job" machinery will do well to investigate

"Ideal" Hoists
"Ideal" Pumps

When buying equipment buy "Ideal" Power

Original Gas Engine Co.

R. Eolds, Chairman

500 Kalamazoo St. E.

Lansing

Michigan

Continuous Bucket Stone Elevator

handling 300 tons per hour. Note the absence of tracks. The chains are guided by large flanged rollers. This is a heavy slow speed elevator, designed for long life.



STEEL BUCKET ELEVATORS

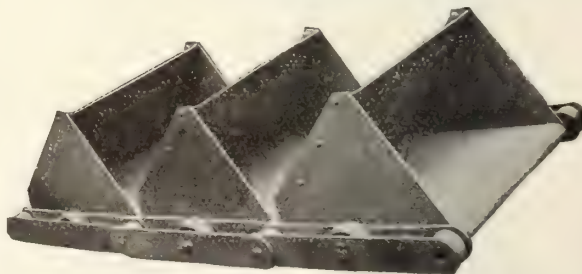
For Sand, Stone, Gravel, Etc.

For the contractor who is handling large quantities of sand, stone, gravel, and other rough material, a Waterous Steel Bucket Elevator will effect economies in time and labor that are worth consideration.

We build Elevators and Conveyors on the Link Belt System, in sizes ranging up to 600 tons per hour capacity, designed and arranged to suit special installations.

Years of experience building transport equipment are built into these conveyors. Send us your sketches and let us figure on a cost-cutting installation for you.

We build Steel Buckets of all types, in any size. Write for prices. Catalogues on request.



The Waterous Engine
Works Company, Limited
BRANTFORD - CANADA

One Municipality Saved \$92,000

**By advertising their tenders in the "Contract Record."
This page tells about in—briefly.**

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

**"Lack of Competition in City Works Has Much
To Do with High Taxes."**

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

"I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being \$92,000 lower than the next-bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "CONTRACT RECORD" saved this municipality \$92,000 or 10% of the total contract. The advertisement cost \$5.00. Would you rather have \$5.00 or 10% of your 1914 estimates?

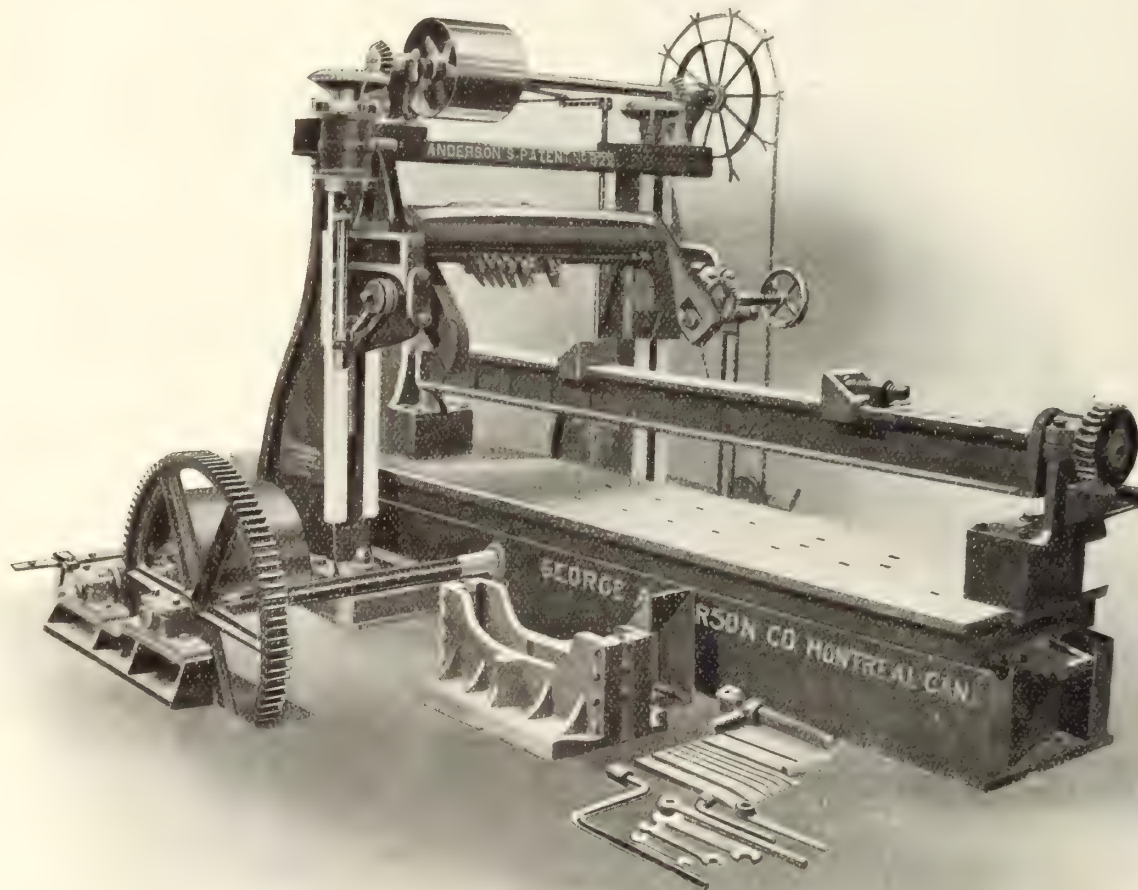
When you are in the market for material or labor send us your advertisement. We will save you money.

Contract Record
and **Engineering Review**

ESTABLISHED 1886

220 King Street West, Toronto

Anderson's Patent Reversible Planer— Slide Type



Extensive experience shows that this Machine will do the work of at least eight men, and is easily 30% *faster* than the general types with single motion tables.

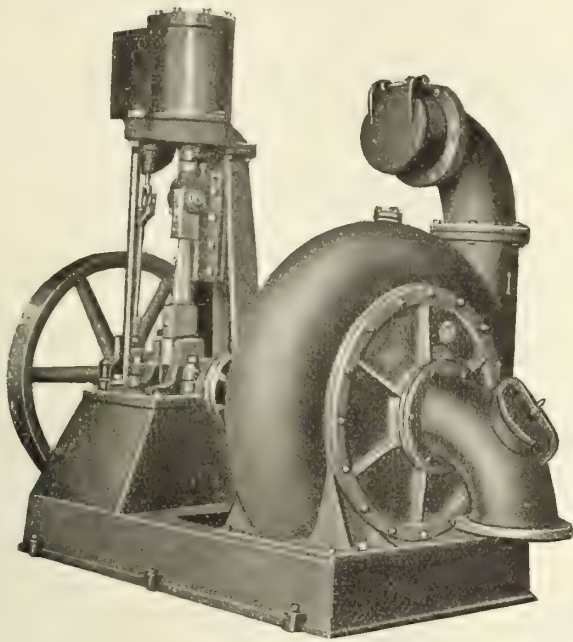
— **OTHERS FOLLOW** —

Cranes — Derricks

Geo. Anderson & Co. of Canada

Limited

Montreal, Que. and Carnoustie, Scotland



Contractors Sand and Dredging Pumps
Complete Hydraulic Dredging Machinery
Centrifugal and Turbine Pumps for
Every Service

MORRIS MACHINE WORKS - Baldwinsville, N.Y.

Canadian Sales Agents—
Storey Pump and Equipment Co., Ltd., Toronto, Montreal

**Let Us Send
 You This New
 Bulletin**

It is filled with valuable information for the buyer and user of cable terminals. There are tables of dimensions, weights, voltages, etc., that should be in your files. Note carefully the following:

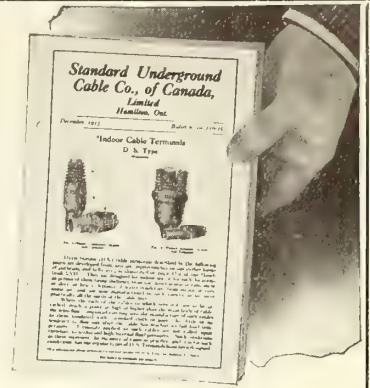


Table of Contents

General Description of D. S. Terminals.
 Regular Types of D. S. Terminals.
 Inner Seal Terminals.
 Wiped Joints vs. Clamped Joints.
 Separation and Insulation of Conductors.
 Insulating Compounds.
 Terminals for Ordinary Service.
 Terminals for Special Service.
 Instructions for Ordering and Installing.

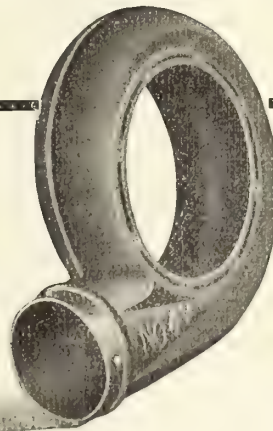
*A card to our nearest office will bring
 your copy of this book. Write now.*

**Standard Underground Cable Co.
 of Canada, Limited**
Hamilton, Ont.

Montreal, Que.
 Boston, Mass.

Winnipeg, Man.
 Seattle, Wash.

Manufacturers of Electric Wires and Cables of all
 kinds, for all purposes, also Cable Accessories.



"Sirocco" Type "V" Universal Fans
 TRADE MARK.

Can be easily and quickly set up or taken down. One machine can be arranged to discharge the air in **four directions** (aside from the various angular discharges) with the pulley on either side of the fan.

Can be used for Blowing or Exhausting. Wheels can be furnished to handle sawdust, shavings, emery dust, wool, fibrous or stringy waste and for sand blast work. Built in sizes to meet most every need.

Ask our Engineering Department to help solve your Blowing and Exhausting Problems.

Clarke T. Morse, 301 McGill
 Building, Montreal
 E. C. Powers, 43 Victoria St.,
 Toronto

CANADIAN Sirocco COMPANY
 LIMITED
 WINDSOR, ONTARIO.

W. P. Eddy, 214 Donald St.,
 Winnipeg
 S. S. Clarke, 605 2nd St.,
 Calgary

John T. Hepburn

Limited

18 to 60 Van Horne St.
TORONTO, CANADA

We build all kinds of Cranes for

HAND POWER
ELECTRIC POWER
STEAM POWER

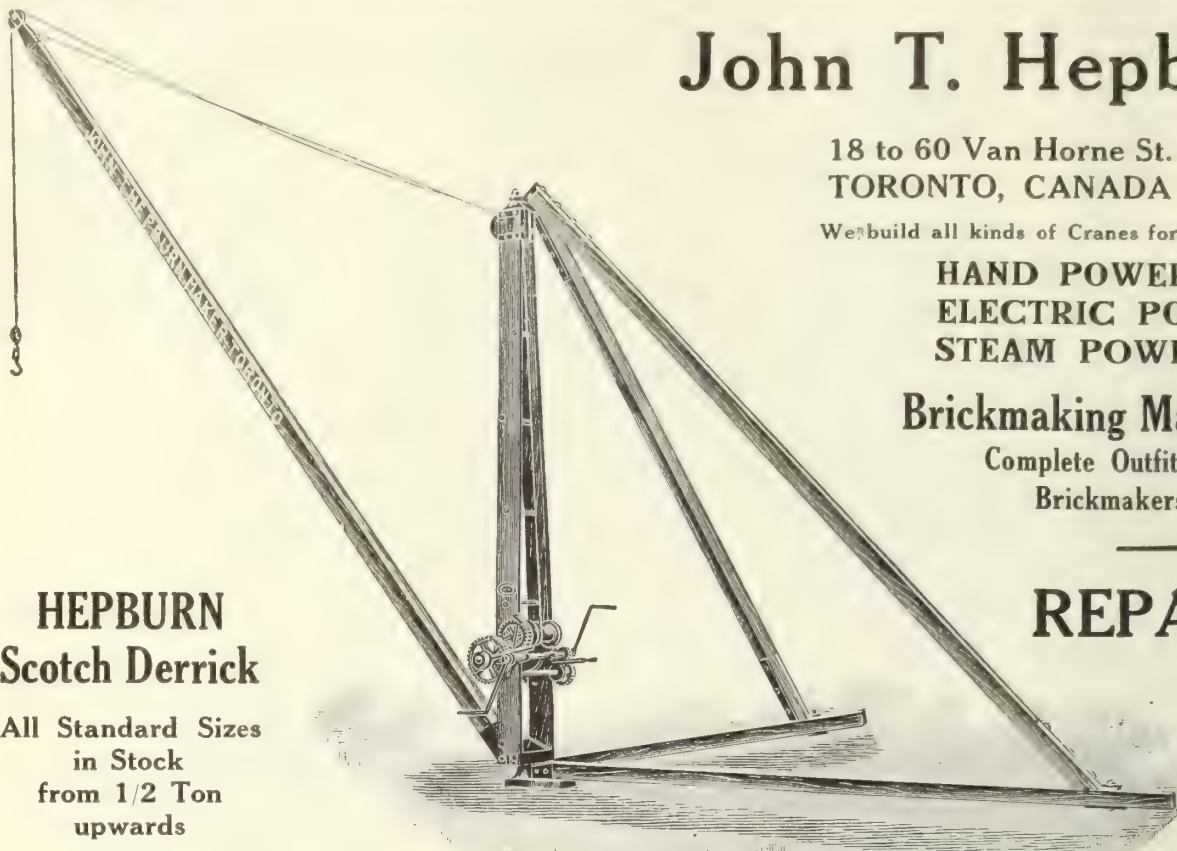
Brickmaking Machinery

Complete Outfits for
Brickmakers

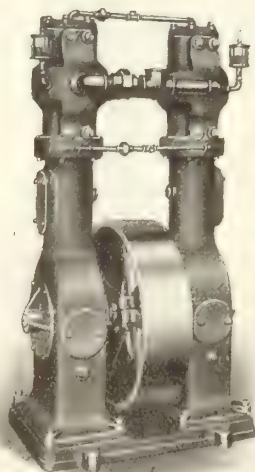
REPAIRS

HEPBURN Scotch Derrick

All Standard Sizes
in Stock
from 1/2 Ton
upwards



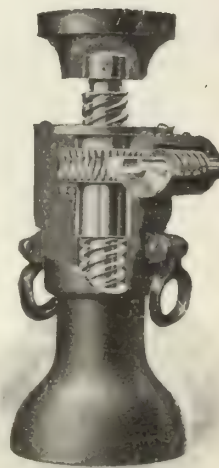
Contractor's Equipment



Duplex Vertical Belted Compressor

The Blaisdell Compressor on the left is suitable for a small plant where a low priced machine is needed. It is water jacketed and is good for pressure to 150 pounds.

The McKernan-Terry Atlas Ball Bearing Jack on the right can be elevated to one-thousandth part of an inch **and remain elevated with the load for any length of time.** This feature has been highly commended by contractors having delicate shoring operations to do.



Atlas Ball Bearing Jack

CANADIAN ALLIS-CHALMERS, LIMITED

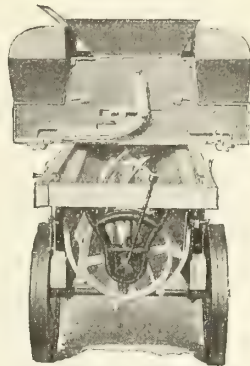
Manufacturers of:—Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Locomotives, Logging Machinery, Mining Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialities, Steam Turbines, Structural Steel Transmission Machinery, Turbine Pumps, Water Pipe, Water Wheels.

HEAD OFFICES, TORONTO. District Sales Offices, Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert

"The No. 5 Coltrin Concrete Mixer I Bought of You Five Years Ago Has More Than Proven Satisfactory.

All the Expense I Have Been to is One Drive Chain I Bought One Month Ago."

—E. B. STOUT, Maitland, Mo.



No. 12 Coltrin Mixer

The Knickerbocker Co.,
Jackson, Mich.

Maitland, Mo., Feb. 16, 1914

Gentlemen :—

The No. 5 Coltrin Mixer I bought of you five years ago, has more than proven satisfactory. I have a machine that turns out three thousand tile per day, two block machines and one brick machine which I run a lot ten months in the year. The Coltrin Mixer has mixed all the concrete for these machines. All the expenses I have been to is one drive chain which I bought about one month ago.

It looks like it is ready for five years more work. It certainly is hard to beat. It is easily cleaned, easy to operate and does its work well. Was I to get a mixer, it would be a Coltrin. It is good enough for me.

Yours very truly,
(Signed) E. B. STOUT.

Study the Mixing Method

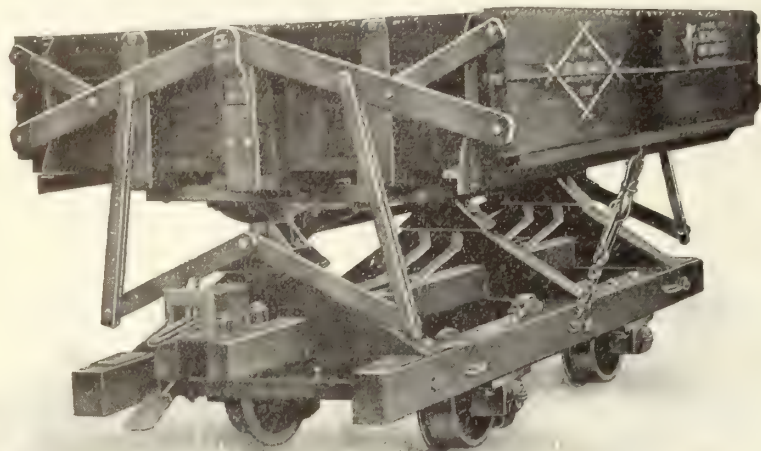
Which has gained such a remarkable reputation of producing uniformly good concrete at a minimum cost for

The Coltrin Continuous-Batch Mixer

Shipped anywhere on trial

For Sale by Bournival & Co., 333 Notre Dame St. East, Montreal, Que.

The Knickerbocker Co., Jackson, Mich.



Equipment is Used on all
the Largest Contracts

Small Size Dump Cars

For contractors on small jobs, or for jobs
where larger capacity cars are
not required.

Showing standard construction of our Wood Frame Dump Cars $1\frac{1}{4}$ and $1\frac{1}{2}$ yds.

"GLEN GARRY" $1\frac{1}{4}$ AND $1\frac{1}{2}$ YD. TWO-WAY SIDE DUMP CARS

A great many contractors have found the above sizes very handy for certain jobs. These cars are strong enough for steam shovel use, but we recommend them for hand shovelling and horse draw. They have all the good features of this famous line of cars and differ only in size. Each door can be thrown up, or both doors together so that shovelling can be done from both sides at once. Being shipped in the knock down in carloads they load many more than other makes.

Manufactured Exclusively by

The Schell Foundry & Machine Company, Limited

Write for prices.

Alexandria - - Ontario

Send for photographs.



A typical view in Montreal West, P. Q.

"The Town of ASBESTOSLATE"

Montreal West is the Garden Suburb of Montreal, and, as you can see from the type of houses illustrated above, it is as substantial as it is charming.

The most noticeable feature of the town is the number of ASBESTOSLATE Roofs, in their soft, attractive greys, reds and blue blacks. Asbestoslate conforms to the Building By-laws requiring fireproof con-

struction, is reasonable in price, and absolutely weather-proof and permanent.

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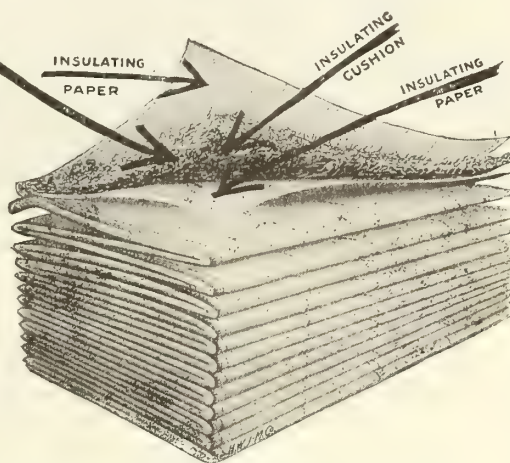
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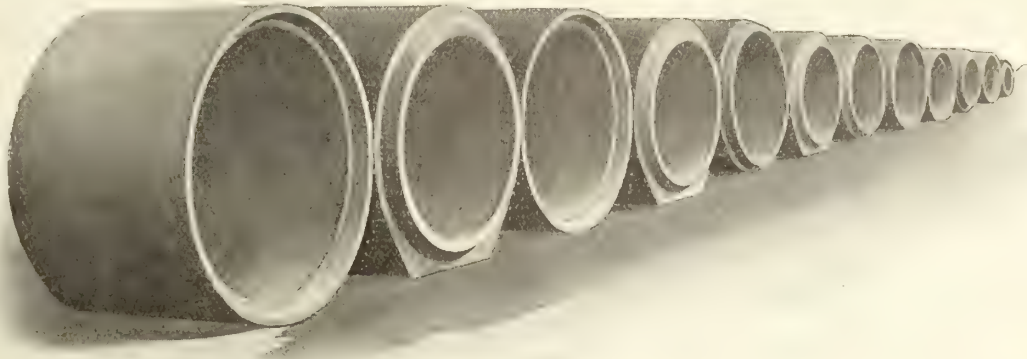
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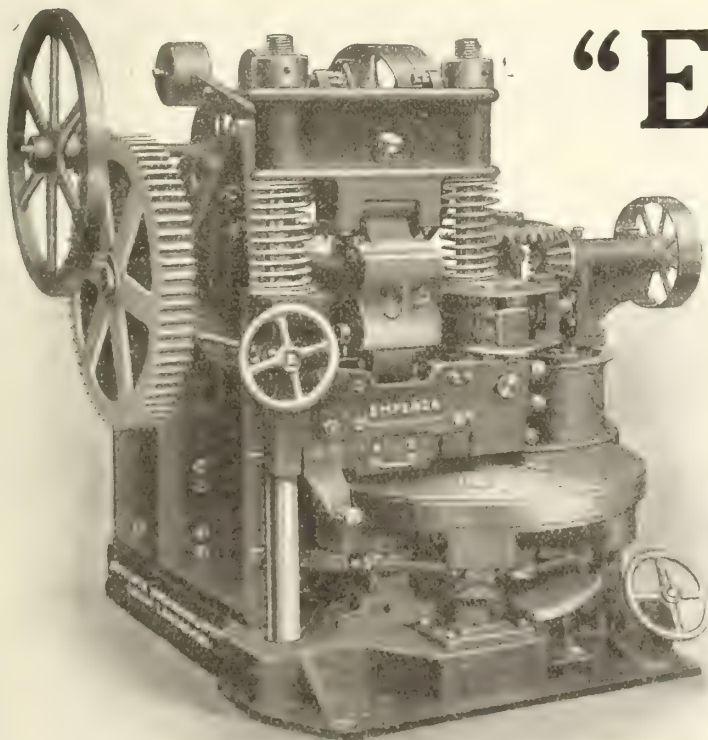


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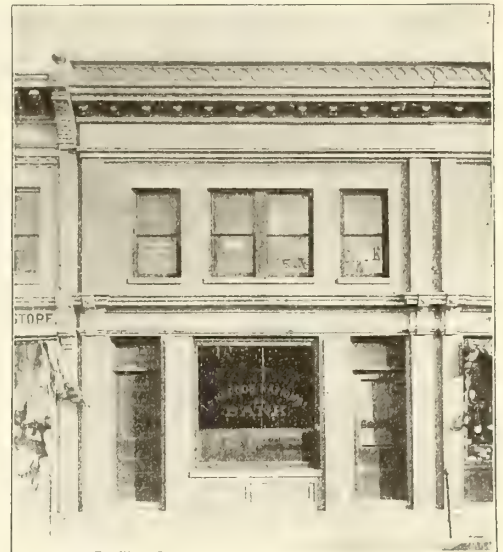
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Contract Record I

ESTABLISHED 1886

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The Organization of Engineering

IN his recent presidential address (extracted in this issue) delivered before the Society of Engineers, Mr. H. C. H. Shenton pointed out that the profession of engineering requires organizing. As things are now anyone may call himself an engineer, and the word in consequence conveys at the best a confused conviction to the public mind. Mr. Shenton proposes "a controlling body representative of every branch of the profession," and the suggestion calls for the strongest support. Such a movement should, however, be international, or at least, as a preliminary step, embrace all English-speaking nations. Existing societies could maintain their autonomy, although having regard to the deplorable duplication that has marked recent years, much in the way of amalgamation would doubtless follow. The reading and discussion of papers is one of the main features of most societies, and much is said as to the importance of shoulder-rubbing and view-exchanging. How much more advantageous would it not be if meetings could be fully representative and better attended? A civil engineer reads a paper on the installation of a pumping plant. He describes in detail the work in cutting, tunnelling, embanking, pipe-laying and so forth; but he carefully refrains from more than a cursory mention of the pumps themselves for the simple reason that he knows nothing about them except what he has gleaned from the maker's specification. Such a paper might well be the joint production of a civil and a mechanical engineer, and with both civil and mechanical engineers in the audience a full discussion might be expected and the representatives of both professions considerably enlightened. The organization of joint meetings would be an immense forward step, and it could be effected only by some central committee consisting of members delegated by the various bodies represented. How much better organized could not the last International Road Congress have been had the numerous societies and interests concerned in it been regularly in touch with each other! Another very strong point in favor of a central committee—the term "controlling body" is open to objection—is the exchange of "Proceedings." Every society of any importance now issues in book or magazine form the papers presented to it, but each society jealously confines the circulation of its publications to its own circle. It would surely be of benefit to, say, the Canadian Society of Civil Engineers if those members who so desired could receive regularly the "Proceedings" of the Institutions of Civil, Mechanical and Electrical Engineers; and the converse would apply equally. The expense need not be great, while the educative advantages would be incalculable. The engineering profession is, in fact, split up (with quite a few exceptions) into a number of ineffective bodies, which are for the most part merely mutual admiration societies. And meanwhile, there exists an untrained horde of incompetents, who by push and effrontery, bustle and bluff, divert the fees from the legitimate pockets. In the "letters" contributed by our London correspondent it has been shown how an electrical engineer can attain the premier highway engineering post in England the while good men, of the highest ability, languish on a road foreman's wage.

It is estimated by a United States firm that the loss in cement which adheres to empty cement bags, or is shaken out into the air, amounts to about \$300,000 a

year. In order to enable cement manufacturers to obviate this loss, a dustless, cheap and efficient method of cleaning bags has been introduced by the Century Cement Machine Company, of Rochester, New York. The machine employed is of simple construction, occupying little floor space and capable of being worked by a boy if required. Every bag is counted as soon as cleaned, and after fifty bags have been cleaned a bell rings to notify the operator.

"Mere Accumulation of Building Material" a Cheap Form of Advertising

WHAT was described as "mere accumulation of building material"—to wit, the modern skyscraper—together with the tendency to seek this cheap form of advertising, was discussed editorially in our issue of January 28 last. It is possible that many members of the architectural profession refrained from taking part in the discussion for fear that they should go on record as being opposed to this class of structure and possibly lose thereby. It might be pointed out in passing that reticence of this kind is rather a sign of weakness than of strength, for it is fair to assume that if a man never gives expression to his views his opinions are unstable.

Interesting comment on the subject was submitted by the well-known Montreal architect, Mr. Philip J. Turner, F.R.I.B.A., whose letter published in our issue of February 18 was a well-considered statement of the pros and cons. Mr. Turner made a strong plea for uniformity of treatment in the design of buildings and for careful planning in the layout of our cities.

In our editorial article we cited the example of the United States as something to avoid—that is, in regard to the erection of high buildings in congested spaces. For this reason we cannot very well overlook an editorial consideration of the subject given in a recent issue of the *Engineering Record*. It will be noticed that our contemporary favors a maximum height of one hundred feet. That such a recommendation should be made by one of the leading constructional journals of New York City—the home of skyscrapers—is particularly suggestive of reform and encouraging to those who desire to see Canada built up upon rational and hygienic lines. We quote our contemporary:

"One would think that the recent publicity given to building-height limitations would have awakened cities throughout the country to a realization of the need for appropriate enactment. Detroit has heard and is considering a height-limitation ordinance. Minneapolis is either in blissful ignorance of the danger to its civic future or prefers advertising to sensible civic development. The tallest completed building in Minneapolis is twelve storeys, about 150 ft. high, but one reaching 200 ft. is to be started the first of May. Unless all previous experience is contradicted, then will begin the senseless rivalry as to height, and some competitor of the owners of the proposed structure will show that they can "go them one better." Minneapolis is known far and wide as an unusually fine city—one endowed with natural advantages and blessed with wide streets and good transportation facilities. The more's the pity that it should endanger its good reputation by courting the congestion in street traffic and overtaxing of transportation facilities inevitably accompanying excessive building heights. The present maximum, 150 ft., is a good point at which to stop. There is no excuse for exceeding it. It is contended in all cases that land values require high structures in order that

there may be a fair return on the investment. That, however, is the starting point of a vicious circle—tall buildings increase land values; increased land values require higher buildings; these higher buildings still further increase the land values, and so on. Another argument advanced in favor of the tall building is that a compact business district is a necessity if a town is to be commercially important. That idea has been exploded by New York's expansion. The business district now stretches from the Battery to Forty-second Street—4 miles—and the section farthest from the Wall Street district is growing at the greatest rate, showing that its 3-mile removal from the former hub is not detrimental. The proposing offender at Minneapolis is a bank—the class of institution that most quickly responds to appeals for the support of civic projects. It has an unexampled opportunity to show its civic patriotism—by abandoning its 200-ft. monster and keeping within the present maximum limit. If its civic patriotism is unequal to such a sacrifice, the municipality should lose no time in passing a height-limiting ordinance, so that imitation may be impossible or may be checked as quickly as justice dictates.

"What has been said above about Minneapolis in the preceding note applies with equal force to many aggressive cities throughout the country. Particularly in the southwest is there danger of unnatural striving after advertising through high buildings. In such places as Muskogee, Oklahoma and Dallas, Texas, the number of tall buildings in relation to the land values is astonishingly large. These cities, and many others like them—notably the thriving Lake cities—still have their civic futures before them. They can make places of beauty or, like New York and Chicago, can advertise in haste and repent at leisure. Experience in the New as well as in the Old World is against the tall structure. London, Paris and Berlin have as much reason for the tall building as New York or Chicago. They have refused, however, to allow the vicious-circle argument to be started and have held their maximum height to less than 100 ft. This limit may well be adopted in all American cities which have not already gone so far beyond this mark that retreat is impossible—and now is the time to do it."

An electrical process for purifying clay, brought to the notice of the English Ceramic Society by Dr. W. R. Ormandy, depends upon the fact that clay is electro-negative, while its chief impurities are electro-positive. The emulsified clay is partially coagulated by adding electrolytes, and is further purified by passing through a vessel having electrodes differing by 60 to 100 volts. The clay substance, with as little as 18 to 20 per cent. of water, is deposited as a continuous blanket four and one-half feet wide and a quarter of an inch thick. Even fine particles are removed, and the solid product may contain as much as ninety-nine and five-tenths per cent. of china clay.

The highest tower hitherto erected for the distribution of concrete by gravity is one, 203 ft. 3 in. high by 6 ft. square, now being used in the construction of a railway viaduct in Baltimore. The tower is entirely of timber, the hoisting buckets, each of half a cubic yard capacity, discharging into 10 in. spouts, 350 ft. long, through which the concrete flows directly to the moulds where required.

According to an official statement issued recently, there are something like 330,000 unemployed men in New York City at the present time. These include 140,000 unskilled laborers and 70,000 workers in the building trade.

A General Review of Professional and Technical Matters Affecting the Interests of the Engineer

ONE of the ablest and most comprehensive treatises of the kind that we have had the pleasure of reading is the presidential address delivered last month in London before the Society of Engineers by Mr. H. C. H. Shenton. We make no apology for the copious extract given below, for Mr. Shenton's observations constitute a careful analysis of the broad principles of engineering, and these principles find a common level in both England and Canada—and the world over for that matter. The leading editorial in this issue is devoted to one of Mr. Shenton's topics, the organization of engineering, and it is to be hoped that readers of this journal will take full advantage of the invitation which we now extend them to contribute their views.

Of the other important matters considered by Mr. Shenton, special importance attaches perhaps to the real economy of scientific treatment and the necessity of employing only thoroughly competent engineers. A great deal of public money has been wasted in Canada owing to shortcomings in the designs prepared by small-salaried men of general experience in cases where specialists should have been called in. The history of our larger municipalities is a record of inefficiency in the handling of water and sewage. We are all quick to blunder and slow to learn: Canada has been particularly slow in learning that the best is the cheapest.

Every paragraph in Mr. Shenton's address affords food for reflection. The systematic hydrographical survey that he urges is something which might be considered here. His remarks concerning the consulting engineer are suggestive to Canadians. The economy of the best professional assistance is illustrated by the failure of certain structures in this country.

The proper value to place upon the advice given by manufacturers is not the least important of the remaining topics of an address which is deserving of the careful study not only of all municipal engineers but of all those others who have a part—or a pretended part—in municipal administration. Our extract follows:

There are many signs that there is need for better organisation in the profession. This is to be observed both in England and in America, and a great deal of consideration has been given to the matter; but at the present time many of the efforts made are individual and spasmodic, the work done by the largest body of all—viz., the Institution of Civil Engineers—being, in a great measure, unknown to the vast body of engineers. Some societies make such work the nominal object of their existence, and incidentally it may be observed that the mere existence of any society of engineers should tend in the direction of proper organisation of the profession, for the first rule of that society should be that its members shall be engineers.

Engineering is an honoured profession, and good engineers receive quite as much consideration and respect from the general public as they either desire or deserve. No better organisation of the profession will increase the respect with which a properly trained and qualified engineer is regarded at the present time. There is nothing in the profession as it stands which makes it in any way less honourable than the highest professional calling. The trouble is that the

general public often regard persons as engineers who have absolutely no claim to the title, such persons being allowed to call themselves engineers without hindrance.

The Society of Engineers is at the present time devoting considerable attention to the subject referred to—viz., the organisation of the profession, and the well-being of the engineer—and will spare no pains in the future to promote this object. Such work is being considered not as an isolated effort in opposition to what is being done in the same direction by other societies and institutions, but is taken up with the object of ultimately securing a combined effort of the whole profession, and the formation of a controlling body representative of every branch of the profession, which would thus be in a position to accomplish effectively the reforms which are generally admitted to be necessary. This is not a selfish undertaking done simply for our own honour and glory, neither are we arrogating to ourselves a right which belongs equally to other societies, but it is a genuine effort to increase the interest of engineers in a movement to their own advantage, and to support loyally any satisfactory effort that may be made by others.

Although there is nothing wrong with engineering as a profession, there are a great many difficulties with which the engineer has to contend which come under consideration. The employment of persons who are not engineers to do engineering work is one of them; the employment of engineers at an improper rate of payment is another—to give only two instances. In the legal profession no unqualified person may practise as a solicitor under a penalty, yet in the engineering profession, where human life is sometimes dependent upon the work, no such safeguard is to be found. It is quite a common thing to find an overworked surveyor in a rural district receiving a salary of perhaps £60 or £70 a year, dealing with the spending of very large sums of money on purely engineering work. If the profession were properly organised such a person could not be found. If he were competent he would not be allowed to work for insufficient pay, and if he were not an engineer he would not be allowed to do the work.

I would therefore urge that all engineers, whether they are members of this society or not, should regard the serious effort that is being made for the better organisation of the profession, and that they should assist us by bringing matters pertaining to the subject to our notice and by working in friendly conjunction, and should remember that we, as a society, are anxious to assist them in anything that can have a useful bearing on the subject.

Waste of Public Money

Much public money is wasted owing to these causes, and taking only one expense—viz., that of the work done by local authorities by persons who are not engineers—the fact is perfectly plain, and it is therefore necessary in the public interest that engineers should combine in the endeavour to make it impossible that their work should be given to persons outside the profession. Again—and here I speak on my own subject—it is equally important that such works as those of sewerage, sewage disposal, and water supply should be carried out by engineers who have special knowledge and experience of these particular subjects. At the present time this country is full of instances where the public money has been wasted by the construction of works which are quite unsuitable for their purpose. If the list of failures in sewage disposal works and in water supply works were recorded, to-

gether with the names of those responsible for the work done, the result would be very instructive.

Again, this appears to be an age in which any person, without respect to his qualifications, may pose as an authority, and write a text-book for the use of students. There are to hand at the present time examples of recently published books on engineering matters, and especially upon the subjects of water supply and sewage disposal, which are full of obvious errors. Such books may be useful enough to the engineer of experience who can discriminate between right and wrong, but it is grossly unfair to the student to put into his hands a text-book calculated to lead him astray. It seems as if all that is required at the present day is for a person to make an assertion. The assertion goes forward, frequently without comment, as a fact, and becomes a source of error. The authority is generally unquestioned. This is an unreasonable attitude on the part of the public, including sometimes engineers. If a great engineer of world-wide reputation makes an assertion, that is merely his opinion, but we have it on good authority, and it is therefore of great value; but if an unknown person of inconsiderable attainments writes a book and makes various hard-and-fast rules and assertions, these ought not to be allowed to go forward for the guidance of students without proof. It seems as if some sort of Press censorship is desirable. A department might be formed for the careful reading of new books written by unknown authors, with a view to their inclusion in a list of text-books suitable for students preparing for examinations. Naturally, when a student visits such a library as that of the Institution of Civil Engineers, he is inclined to regard the books in that library as having received the approval of the institution, whereas such libraries receive books both good and bad. I have certainly come across books and writings recently which bear traces of the mental aberration of the author, but such books frequently receive no proper criticism in the engineering press, and may be accepted as among the number of ordinary text-books.

Again, some of these books are written, if not by manufacturers themselves, by those who appear to be willing to advertise the goods of a special manufacturer. A book upon water supply, for instance, may, under the heading of "Water Purification," speak of a certain make of mechanical filter as if that filter were the only one of its kind, and may entirely omit to mention the large number of other methods which exist for the purification and treatment of water.

Water Supply

At the present time there are certain definite lines of policy that are observed in connection with water supply, and certain principles have also been accepted which will have a far-reaching effect upon engineering work in the future. These are of various kinds, and are the outcome of general experience, research work, the work of the Royal Commissions, and other causes. It has been established within the last few years, and has been definitely confirmed by the Eighth Report of the Royal Commission on Sewage Disposal, that water authorities must be responsible for purifying waters drawn from a river, while the local authority discharging sewage into a river need only purify that sewage to such a degree as to prevent actual nuisance.

It is also now generally acknowledged that there is need for the collection throughout the country of data as to sources of supply. A systematic hydrographical survey is required. We need to have fuller particulars with regard to rainfall, the run-off of the land, and the yield of streams and rivers. The formation of a central authority and of water boards is required so that the national supply shall be considered as a whole, and although legislation is slow, there can be no doubt that we shall ultimately obtain what is required, and that eventually the whole matter will be administered much more satisfactorily and economically than is at

present the case; for it is obviously very wasteful when one large community, which happens to be divided into two or more districts, is allowed to spend money upon two or more separate schemes, when one large scheme would have met the requirements of the case much more satisfactorily. The combination of districts is to be desired; the appropriation of the sources of supply and gathering grounds by one water authority to the detriment of others is to be deprecated, and the enormous expenditure of money, owing to the conflicting interests, that takes place whenever any scheme is brought forward, ought to be avoided. As things stand at present it is generally acknowledged that reform is required.

Economy of Scientific Treatment

Another even more important point that has not yet received the general acceptance that it will receive in the future, is the absolute need of water supply problems being placed in every case in the hands of those who can deal with the matter scientifically, making use of the most recent knowledge and experience on the subject.

It is becoming more and more evident that the engineer must work with the chemist and bacteriologist. To give a few instances: If the water supply of London had not received this thorough attention we should long ago have had to abandon our present sources of supply, and enormous expense would have been incurred in bringing water from a source further afield, but owing to the fact that the whole question has received the very best attention, we have a combination of districts, a reduction of waste, a water drawn from sewage polluted rivers rendered fit for drinking purposes, and what would at first sight appear to be quite impossible brought to successful fulfilment. The same thing applies exactly in other cases. For though the smaller works are of less importance, regarded collectively, from a national standpoint, they are of greater importance even than the supply of London. It is not sufficient for the engineer to obtain a supply of water free from disease germs, obvious pollution, discoloration or objectionable mineral constituents. A water which is apparently desirable in every respect may yet cause very serious corrosion in mains, and algal troubles in the reservoirs, may be productive of animal and vegetable growths in the mains, and may clog the filter. The conditions need to be much more carefully considered than has formerly been usual, and in this the engineer needs very considerable assistance from the chemist and bacteriologist. We are well aware that hard water may be softened, and the fact that plumbo-solvent waters may be treated with lime so as to remove this quality is fairly well known, but it is quite a new idea and one that was only recently brought forward in a paper read before this society by Dr. Eric Rideal, that a water may be treated in such a manner as to provide a protective coating to the interior of an iron main, so that corrosion shall not take place. In a report issued by the Institute of Metals such treatment of water was recommended in connection with boiler tubes, but it did not appear that anyone had suggested that it could be applied satisfactorily in the case of water mains. The protection of the interior of water pipes is not an easy matter, and if it can be effected by the treatment of the water it is clear that there will be a saving of expense, because this treatment would only be required at long intervals of time.

The manufacturers and patentees of various processes act upon scientific advice in many cases, but they are naturally special pleaders for their own particular systems, and as commercial men cannot be expected to give the disinterested advice that is given by the private engineer. Unfortunately it is quite a common thing for work to get into the hands of persons who, possessing insufficient knowledge, rely entirely upon advice obtained from manufacturers. This is particularly so in the case of water treatment, and it is also true to some extent in the case of other matters, such as re-

inforced concrete, which matters will be again referred to.

It has hitherto been generally taken for granted that if a certain water produces corrosion or clogging of iron mains, the only cure for the difficulty would be to put in mains which are of such a character that they will not corrode. Thus pipes are coated with preservative solutions, sometimes with Portland cement, metallurgists seek to find a metal which will not corrode, reinforced concrete pipe, wood stave pipes, and so forth are suggested, but all recent experience tends to show that it is not so much the pipe which is at fault as the water, and that if the matter is dealt with scientifically the corrosive qualities can be removed. This is but one example of the importance of the question being dealt with as a whole carefully and separately in each case, by the best scientific advisers, including engineers, chemists and bacteriologists. In cases where underground supplies are in question it goes without saying that the assistance of the geologist is also required.

The Consulting Engineer

On small works the work of the engineer-specialist, the consulting engineer proper, ought to be very carefully distinguished. It certainly seems that the use of the consulting engineer on such work is not properly understood by his clients. Such an engineer is called in to prepare a scheme, and to advise as to the expenditure of a large sum of money to the best advantage. Unless he has considerable knowledge and experience he cannot do such work. It is work of the first importance, and should be highly paid.

As a striking example of the folly of approaching water-works problems unscientifically may be instanced the large number of dams which have failed in America and elsewhere. In most cases these failures have been due to lack of geological knowledge. The dams themselves have been quite strong enough to withstand the water pressure, but the water has managed to find its way underneath them. We have many instances in this country as well as abroad of the difficulties which have occurred owing to the particular geological conformation of the ground.

It is wrong to take the view that the engineer can be a specialist in all subjects, and it is perfectly correct, for instance, for the municipal engineer to call in the consultant to advise him or his council in case of need, in the same way as the town clerk will require to have counsel's opinion upon any difficult point of law, and it is also perfectly correct for the consulting engineer to require the advice of other engineer-specialists, of chemists, geologists, bacteriologists, and so forth, as the case may require. If the profession is to be properly organised, the consulting engineer ought not to undertake personal work for which he does not specialise. It will at once be urged that under such conditions it might be impossible for him to earn a living; but this is not so, for if each man undertook to do only the work for which he was specially fitted, and if other engineers refused to do that work, it stands to reason that he must of necessity receive a great deal more of his proper work, and that he would do this with greater advantage to himself and to his clients than could possibly happen in the case of work that rightly belonged to some other engineer. He would have to pass on such work as he was not personally well qualified to do, and for which he has even now to pay away the bulk of his profits to skilled assistants, if he carries it out properly. It is still worse for an engineer to take up work which he does not understand, and to obtain advice from manufacturers who, in some cases, even go so far as to call themselves consulting engineers.

Advice Given by Manufacturers

These manufacturing firms employ expert assistants, but they give designs and advice free of charge in order to sell their appliances, and although they, the manufacturers, may receive disinterested advice from the engineers whom they

employ they must recoup themselves, and if they, as commercial men, do not give disinterested advice they cannot be blamed. This is particularly the case with regard to reinforced concrete. Many persons, having a reinforced concrete structure to build, obtain their designs free of charge from the manufacturers of reinforcing material. If they possessed the knowledge required they would design their own structures, and if they cannot do this they ought to consult a specialist and work with him, and pay him for his advice. The Local Government Board have very properly raised very serious objections to the reinforced concrete designs brought forward by the officers of local authorities when it was perfectly clear that such officers had a very imperfect knowledge of the subject, and relied entirely upon advice given by manufacturers.

Similarly in water purification or sewage disposal there are many instances of persons obtaining direct from manufacturing firms designs which may or may not be the best for the purpose, but which of necessity are designed by the manufacturers in order to sell their particular appliances. If this system of obtaining designs free of charge from manufacturers is to be admitted as being in conformity with the rules of the engineering profession, it follows that any person of organising capacity, however limited his knowledge of engineering may be, may carry out very large works which are really designed by other people, and about which he is quite incompetent to express an opinion, and to charge the full fees of a consulting engineer for doing so. Moreover, the system is most unfair to the manufacturers, who, in order to keep their trade, must prepare a very large number of designs which are never used, without making any charge for them, such designs frequently being required merely for estimating purposes. If the profession recognised its responsibility in such matters, and could educate public opinion in the right direction, there would be a great saving in time and money to the manufacturer, and only the properly qualified engineer would be able to take up work.

Recent Developments in Water Engineering

Of recent developments in water engineering the various methods for the treatment and purification of water are very remarkable. The possibilities seem almost infinite, as if there were no water, however impure, which could not be raised to a high standard of purity by adequate treatment. The growing practice of purifying swimming bath water, and using it over and over again for months demonstrates extraordinary possibilities. It has been found that, after many months' use, water so treated is quite equal in quality to the ordinary town supply. The use of the mechanical filter, together with chemical treatment, has increased enormously, and there are many instances of the employment of such filters dealing with several million gallons a day, some of them being in this country. There are also many other filters of various types which have their uses according to special conditions, and the slow sand filter is still very largely employed. Sterilisation of water by means of hypochlorite has been very generally adopted in America, and also, to some extent, in this country, notably as an after treatment with the mechanical filter, and there is abundant evidence to show that the typhoid death-rate has been lowered, and sometimes lowered to zero, as the result of this treatment. Ozone sterilisation is in use on the Continent at a good many large installations, and the ultra-violet rays have also been applied to the sterilisation of comparatively large town supplies in France. It cannot be said that these methods have made much headway in this country, the reason being that our supplies as a rule, are not open to the objection of gross pollution. It is, however, notable that Dr. Houston has advised the Metropolitan Water Board to sterilise the flood waters flowing into the storage reservoirs by means of an overdose of lime, and it is also notable that the ordinary lime treatment seems to in-

clude sterilisation apparently unsuspected hitherto, at any rate in some cases.

The Work of State Departments

The value of hydrographical surveys and of State consideration of water supplies is shown at present chiefly by the work done abroad. The work in America is well known, while in our own Colonies we have such examples as the case of Western Australia, where the State engineer, having reported a large sub-artesian basin existing under the drier districts, boreholes were sunk throughout the sandy plain, with the result that good supplies were secured at depths of from 20 ft. to 100 ft. The good work was assisted by the Government, who lent the settlers hand-boring plant. Thus great advantages were derived and many wells and reservoirs were made. It is questionable whether the same degree of praise is to be given to the German Government, who recently sent a water diviner to South Africa "to practise under State patronage the cult of the divining rod."

Pumping

One of the most important changes in connection with water engineering has been in pumping. The use of the high speed engine, the steam turbine, the internal combustion engine, and the electric motor has resulted in the development of the rotary pump. Centrifugal pumps are now largely used, and by running in series are found to be efficient and useful for very high lifts. Producer gas is found to give economical results for large and small powers, and its application is very marked. Further, we have the Humphrey explosion pump, which does away entirely with the engine and most of the working parts of the pump. This pump is also being used for sewage lifting, and apparently has an application for both small and large supplies where a moderate lift is required.

Water Waste

An interesting point relating to some of the older systems supplied from new sources under great pressure is the effect which a largely increased pressure has upon the old mains, services, valves and fittings. This is particularly the case with regard to New York, where it is feared that the increased pressure may lead to a considerable loss of water from various causes. It is certainly a point to be borne in mind where a new supply at a higher pressure is provided. In London we have a splendid example of what may be done by careful inspection and scientific management in reducing the loss of water due to waste, but such methods, are not by any means universally adopted. In American cities the waste is apparently enormous, and a great deal of interesting work is being done in order to reduce this waste. The pitometer is a simple instrument which has been proved to be exceedingly useful in measuring the flow in water mains, and by its use a great deal of waste has been discovered. Great carelessness is sometimes shown in this country with regard to waste. In one instance within the writer's experience a small town whose population had not increased in any marked degree since the waterworks were constructed, found it necessary to duplicate its well, reservoir and pumps owing to the insufficiency of the supply. It was clear, however, that enormous waste was taking place, and eventually a 4-in. main was discovered at the lowest part of the system broken in half, discharging into the river, but the great point is that this discovery was not made until the works had been duplicated.

Water Mains and Reservoirs

The use of steel mains is largely on the increase, and appear to be taking the place of cast-iron mains in a great many cases.

With regard to reservoirs, the chief advance is in connection with reinforced concrete, which is undoubtedly a very economical and useful material.

One of the most noteworthy features of recent practice is the increased use of cement injection. We see, for instance, in the case of the Catskill aqueduct, that the pipes were made of concrete, and that these were made watertight by systematically injecting cement grout under pressure behind the walls of the tunnels. There are several instances where extensive fissures causing leakage under reservoir dams have been satisfactorily filled with cement grout forced in under pressure through borings. The same method is sometimes adopted in order to form masses of concrete for foundations where clean gravel exists under water. Some interesting experiments have recently been carried out with regard to this matter. The rendering of surfaces by means of the cement gun, wherewith cement is thrown out under pressure from a nozzle and applied to the surface to be treated is worthy of note. The method has also been used for lining large pipes.

With regard to the storage reservoirs and the construction of dams, recent progress shows that very much more attention is being given to geological considerations than was formerly the case, and that it is worth while to give very much greater attention to preliminary investigations with regard to the site of the reservoir, and to prove by every possible means its suitability before starting the work. Sir Alexander Binnie, in his recently published book, has laid the greatest stress on this point.

Dr. Houston has shown in the case of London that storage reservoirs may be used for water purification, it being found that a few weeks' storage is sufficient to kill or to devitalise harmful germs. The method is hardly likely to be very generally applied, because the water probably does not need such purification, and, moreover, the cost of constructing the reservoirs makes the system prohibitive in the majority of cases. There are also possibilities of trouble with regard to algal growths in the water.

Sewerage and Sewage Disposal

With regard to sewerage and sewage disposal, we are in a much more satisfactory condition than was the case only a few years ago when practically no attention was paid to the question of whether a nuisance was caused by the discharge of sewage or not. The publication of the Eighth Report of the Royal Commission, shows that this matter has received considerable attention. The officers of the commission, as will be seen in the Appendix to the Eighth Report, suggested that the quality of the sewage discharged was not the chief matter to be considered, but that the stream itself ought to be the ultimate arbiter in the case. Thus, if a stream or river, after the discharge of sewage or effluent into it, were found to be unharmed—that is to say, if it showed no signs of nuisance, and if it retained a certain degree of dissolved oxygen—this should be taken as proof that the sewage required no further treatment. Further, experiments carried out with great care showed that if sufficient dilution were given to screened sewage entering a river, purification was effected by this dilution. The commissioners did not actually adopt this suggestion made by their officers, but advised that the law should be altered so that a person discharging sewage into a stream should not be deemed to have committed an offence, provided that the sewage conformed to a certain standard. They suggested for this general standard that the sewage discharged should not contain more than 3 parts per 100,000 of suspended matter, and with its suspended matters included should not take up at 65 deg. Fahr. more than 2 parts per 100,000 of dissolved oxygen in five days; but they also advised that special standards, demanding either a higher or lower degree of purity, should be made applicable as local circumstances might require or permit. Thus, if the dilution afforded by the stream were very low, the standard would have to be raised, but if the dilution were very great the standard might be relaxed or suspended altogether, and that

if the dilution should be over 500 volumes all tests might be dispensed with, and crude sewage from which the solids had been removed might be discharged. These are most important recommendations, and will no doubt be acted upon at some time in the future.

Bacterial Pollution of Rivers

Experiments in the Great Lakes of America have shown that harmful bacteria from sewage may be carried out for several miles from the shore, and may contaminate water at intakes situated in places which one would imagine to be in absolutely safe positions. The Royal Commissioners do not say anything about the possibilities of bacterial pollution in their Eighth Report, but it is probable that in the case of the American outfalls the reason why harmful bacteria are carried to such great distances in the water is because the sewage is unscreened; for it is certain that with floating solid matters there is no limit to the distance to which disease germs may be carried, and this may account for the many serious typhoid epidemics in America, while we in London, drinking water which is admitted sewage polluted, apparently suffer no ill-effects, and typhoid germs are not found even in the raw waters.

Stand-by Tanks

One of the most useful recommendations contained in the Fifth Report of the Royal Commission was that referring to the use of stand-by tanks for storm water at the disposal works. In the older works filters were generally designed to deal with a certain volume flowing down at a certain rate, and every time this rate of flow was exceeded the sewage escaped over the storm overflow. Now all such sudden rushes are either dealt with partly on the filters, and any excess is intercepted in the stand-by tanks for further treatment.

General Purification

The usual principle at the present time is that of keeping back the sludge by screening, settlement or precipitation assisted by the use of chemicals, so that an effluent containing as little suspended matter as possible has to be treated by the filters. The treatment of this liquid is a matter which has been brought to perfection. It can be filtered and treated till it conforms to any required standard of purity, the degree of purity being limited only by the degree of treatment given. If, owing to exceptional conditions, it is necessary to sterilise the effluent, this can be done without any great trouble, as is practically demonstrated by various works where it has been adopted. It may be added that, although when the sterilisation of sewage was first suggested the idea was ridiculed, the process is now among generally accepted methods, although it is very rarely that there is any need to apply this process. It has been found possible to construct filters of various types in such a manner that they do not clog up. The black, earthy matter that forms in a well-designed filter which has been properly worked is discharged with the effluent, and can be intercepted in settling or humus tanks, which tanks, if properly designed, are very effective in clarifying the liquid.

Slate Beds and Contact Beds

The value of the Dibdin slate bed has been proved, as may be seen in the Seventh Report of the Royal Commission on Sewage Disposal. It is there shown that such beds dealing with crude sewage will, if properly worked, retain their original capacity for an indefinite period, provided that the sludge is regularly and carefully run off. The slate bed thus answers the purpose of the settling tank; but it does more, for, putting aside the question of the reduction of the sludge in volume, it is found that the slate-bed sludge "possesses only a slight odour," and this statement is quoted from the Royal Commission Report. It is much to be regretted that, owing to the simplicity of the principle upon which they

work, the slate bed and the contact bed have very often—one might almost say generally—been badly constructed and improperly worked. Thus bad results have been produced, and discredit has been thrown upon a system which should be of very great value to the engineer. The author having constructed many contact beds in different parts of the country, and carried out a considerable number of experiments both in working and construction, during the last ten years, has found that, with proper working, contact beds will give excellent results, and are specially useful for the treatment of sewage containing a large proportion of brewery refuse. Further, it is possible to fill the beds in such a manner that no crude sewage or effluent likely to cause a smell is exposed to air, and thus one of the chief troubles of the sprinkler filter is overcome. It is not suggested that contact beds are better or more economical in construction than sprinkler filters, but it is suggested that under many conditions, especially at small works, they will be found to give very much more satisfactory results. This presupposes that the same amount of care as is generally given to the construction and working of the filter is given to the contact bed. The nuisance from smell experienced with the sprinkler filter is in the majority of cases not very great, and, as a rule, freedom from smell may be attained by careful preliminary treatment.

Tanks

It would seem that, having regard to the recommendations contained in the Eighth Report of the Royal Commission, the settlement of sewage and various methods for the elimination of sludge will receive even more consideration in the future than they have done in the past, and that filtration may not always be required. Tanks of many kinds are in use, such as the septic tank, the continuous flow sedimentation tank, the quiescent sedimentation tank, chemical precipitation tanks, the hydrolytic tank, and a large number of others too numerous to mention, and it seems probable that, in the future, tanks of the Imhoff type will be largely used. In this type of tank the object is to allow the fresh liquid sewage to pass through rapidly so as to avoid septic action, while the solid matters are retained and held in a separate chamber, where they remain for some time, being drawn off, without emptying the tank, at convenient intervals. It is found that the sludge, after retention in such a tank for a certain time, loses much of its offensive character, and is thus comparatively inoffensive when it is drawn off; but here, again, the whole process is dependent upon careful management.

Sewage Lifting

The lifting of sewage is also a matter in which considerable interest is displayed. The centrifugal pump has been improved to such a degree that it will lift even large blocks of stone. Naturally, the efficiency is not very great under such circumstances, but attention is drawn to the matter in order to show that there is every reason for the growing practice of employing centrifugal pumps for sewage lifting. The use of the small electrically driven centrifugal pump is also noticeable in isolated positions where it performs the work of an ejector, being automatically controlled. This electrical arrangement has been much improved, and it is rather remarkable that so little is heard of it having regard to the remarkable activity upon the part of manufacturers of sewage ejectors. The automatic sewage lift is, under the right conditions, by far the most economical appliance in use.

The Parsons stereophagus pump, a centrifugal pump designed especially for sewage lifting, is also worthy of note.

Sewer Ventilation

The report of the Local Government Board on the intercepting trap tended to demonstrate the comparative harmlessness of sewer gas in general. If the teachings of this report, which has been much criticised, are accepted, it appears that

very little more is required in the ordinary system of sewers than to arrange that there may be no pressure of gas in the sewer, which, as a matter of fact, is really all that is done as a rule in any ordinary town system. It does not justify any relaxation in the efforts made to ventilate sewers, but it is some consolation to be told that the dangers of an ill-ventilated sewer are not so great from a health point of view as was generally believed. The abolition of the intercepting trap suggested is an accomplished fact in some places, which seem none the worse for the change. Whether the principle is of universal application is another matter.

Effect of Traffic

The altered conditions of road traffic and the enormous loads which now come upon road surfaces, and upon manhole covers in particular, should be taken into careful consideration by engineers. There is increasing need for soundness of construction of sewers and manholes and for strength in manhole covers.

Satisfactory Tests of Concrete Sewer Pipe

INSTRUCTIVE details concerning the testing of concrete sewer pipe are furnished by E. S. Wallace, Cement Inspector of Kansas City, who presents some interesting conclusions in a recent report. At Kansas City reinforced concrete sewer pipe 30 ins. and 33 in. in diameter and plain concrete sewer pipe from 10 ins. to 24 ins. in diameter are in use. The cost of the reinforced pipe is \$1.50 and \$1.90 a foot and of the plain pipe from 17c to \$1.06 a foot. Plain concrete pipe up to 12 ins. in diameter is of cement and sand 1:2½. Larger pipe may be of the same mixture or of 1:1:2. The conclusions are as follows:

Our tests have shown conclusively that there are three things essential to the manufacture of good concrete pipe: 1, the pipe must be composed of proper materials; 2, it must be made right, and 3, it must be cured right. Too much emphasis cannot be placed on the fact that curing is as essential as the materials from which the pipe is made, or the method of manufacturing, for it is possible for a manufacturer to exercise all the care possible in the first two matters and ruin the output of his plant by improper curing.

After the molds have been removed the finished pipe should be kept thoroughly moist and at a temperature of about 70 deg. F. for at least 10 days, and in extremely hot or cold weather it should not be exposed to the elements for a much longer period.

During the winter of 1912-13 considerable difficulty was experienced on account of improper curing. The storage sheds were heated with stoves, and pipe placed too near them dried too rapidly while those near the sides of the shed were retarded in setting on account of the cold. It was expected that when warmer weather arrived this difficulty would be overcome, and this was the case to some extent until the extreme dry hot weather came. Then, as the storage capacity was inadequate, large numbers of pipe were placed in the yard, exposed to the air and sunshine, before they were properly cured. This was found to be as great (if not a greater) detriment than the cold weather.

The writer has made experimental tests on a number of 8-in., 10-in. and 12-in. pipe of 10 days age, that were properly cured up to that time, which have resisted from 60 lb. to 90 lb. internal pressure without showing any signs of seepage or percolation. Pipe of the same size and made under the same conditions, and of much greater age, but which had been stored in the open and exposed to the elements, have repeatedly failed below the specification requirements. The manufacturers of these pipes use no waterproofing, and hundreds of tests have demonstrated that none

is required where materials are carefully selected and proper care is exercised in manufacturing and curing.

During the year we have made 530 tests on concrete pipe ranging in size from 8-in. to 24-in., 411 (or 77.55 per cent.) of which passed both percolation and pressure tests. This does not represent the percentage of loss of the output of the plant, as most of the failures occurred during July, August and September, when the weather was extremely dry and hot.

We have practically abandoned the compression tests, as we have never found a pipe of either clay or concrete that failed below specification requirements. There is but little difficulty experienced in handling concrete pipes, as they are not brittle and resist considerable impact before fracturing.

The pipes are made on a machine having four revolving tamping bars, eccentrically worked and striking 300-lb. blows at 150 blows per minute. The core works on a revolving screw and remains stationary during the tamping; then it is started and after making a sufficient number of turns to trowel the interior, it drops below the floor. This trowelling of the interior is important and when the pipe is properly made it has the smooth glazed finish desirable for sewer work. The concrete is a dry mix, fed from an overhead bin through a 3-in. pipe and deposited directly in front of the tampers.

The finished pipe is taken to the curing shed, where it is placed on end and the mold is removed. It is strong enough to stand without allowing additional time for the cement to set. It is kept moist for about ten days before being removed to the storage yard. The concrete is of a consistency that will barely hold together when pressed firmly in the hand, and after the molds are removed the "water web marks" show plainly over the exterior. Our tests have demonstrated that when the mix is so dry that these marks do not show, the pipes show seepage or percolation on test and usually fail at a low pressure.

In 1912, Kansas City laid over 35,000 lin. ft. of plain concrete pipe, and in 1913 over 75,000 lin. ft. in sizes ranging from 8 in. to 24 in. There have been no failures.

The Berlin city council has passed a resolution urging the government to put Goderich harbor in proper condition for entrance in all kinds of weather. The construction of a deep waterway from the Atlantic to the head of the Great Lakes was approved, and it was also decided to request the government to give Western Ontario and the prairie provinces full representation on the proposed Georgian Bay Canal commission, and that the investigation cover the entire route of Georgian Bay to Montreal.

A gravel bed has been discovered at the head of Stag Island, in the St. Clair river, a few miles from Sarnia. In the opinion of an expert the deposit is what is known as a gravel spring which brings gravel to the surface as fast as it is carted away. The local council has forwarded a resolution to the Hon. Robert Rogers, Minister of Public Works, expressing the opinion that the gravel rights should be withdrawn from the private company and taken over by the Provincial Government, in the interest of Sarnia and other Western Ontario towns.

The Toronto Chapter of the Ontario Association of Architects recommends the division into two parts of the City Architects' Department, one to be for the superintendent of buildings, with full charge of all inspection work; the other, an Architects' Department proper—to have charge of the designing work for the city. The superintendent of buildings would have his department divided again into seven sections, a superintendent-in-chief being recommended over each section with inspectors of each class of work under him.

The St. Lawrence River Bridge of the Canadian Pacific Railway*

Features of Design and Construction

By P. B. Motley

THE Canadian Pacific Railway crosses the St. Lawrence River at a point about seven miles from Montreal, near the Indian village of Caughnawaga, P.Q. This crossing is on the best of several trial lines which were located and estimated on, in the years 1883-1885. Amongst the more important were the Nuns' Island line and the Heron Island line, besides the Caughnawaga line which was eventually chosen. These trial lines are located between the Grand Trunk Railway Victoria Bridge and Lachine, the object in all cases being to obtain an outlet from Montreal towards the east and south with the least possible expenditure when the crossing of the river, as well as mileage, were taken into account. The Victoria Bridge is approximately $2\frac{1}{2}$ miles long, and the engineers sought, if possible, to obtain a considerably less expensive crossing.

The Nuns' Island line gave a long crossing of the river in comparatively deep water. The Heron Island line gave a shorter bridge, located for the most part in shallow but very swift water composing the Lachine Rapids. In both these crossings the question of navigation had to be considered and difficulties connected with it weighed considerably in the discussions. The Caughnawaga crossing was finally adopted as being the most economical and as suiting best the requirements of navigation. The bridge is approximately five-eighths of a mile long, and navigation was taken care of by using two through spans of 408 feet each over the deepest portion of the river to allow for waterway, and a headway of 60 feet above high water. This avoided the use of a swing or other movable span which, in this part of the swift flowing St. Lawrence River, would constitute a serious menace to navigation. The span lengths in the balance of the bridge were generally 270 feet and 240 feet, and were dictated by the judgment of the engineers with respect to ice flow in the river.

The decision as to the crossing having been made, the substructure of the bridge was begun, with the late Mr. P. A. Peterson, M. Can. Soc. C. E., as chief engineer in the spring of 1885, and the erection of the steelwork was carried out during the winter of 1886-7. The contractors for the substructure were Messrs. R. G. Reid & Company (the late Sir Robert Reid), and the engineer-in-charge for the company was the late Mr. G. H. Massy, M. Can. Soc. C. E. The steelwork was designed by the late Mr. C. Shaler Smith and the Dominion Bridge Company were given the contract for its manufacture and erection. The steel was especially designed with a view to quick and simple erection, as it was impossible to place falsework in the deeper portions of the river where the 408 foot spans are located. For these reasons the designers decided upon a peculiar type of construction. This consisted of a set of 4 spans (2 deck and 2 through) continuous over five supports, which enabled the steelwork of the side or flanking spans to be erected first on falsework, and the main channel spans to be erected by the canti-

lever method, the flanking spans being used as anchors,—some steelwork was also cantilevered both ways from pier No. 13 located in the centre of the channel. When these several spans were connected, they formed, as aforesaid, a continuous span over five supports, fixed at the centre on pier No. 13 and expanding both ways therefrom. The channel spans, as noted above, were made of through design to allow steamers to pass under at full speed, and Mr. Shaler Smith solved the problem of combining deck and through spans by a very beautiful and interesting method, that of curving the ends of the spans, as shown in the photographs and plans. This procedure is open to criticism from a mathematical point of view, but, considering that the pier supports were founded on rock and, in addition, had adjusting screws, so that the ideal conditions upon which the calculations had been made, could be at all times maintained (if necessary), the design was considered justifiable. The engines, for which the old structure was designed, were equal approximately to Cooper's E35 loading, followed by a trainload of 2,500 lbs. per lineal foot, and the material in the structure was steel, except stringers, counters and windbracing where it was iron. The design lent itself admirably to rapid erection, which was borne out by the fact that the steel took only twelve months to erect ready for traffic. By 1910, the requirements of traffic had necessitated the use of much heavier engines than were considered in the original design and, in addition, the increasing volume of traffic made it advisable to double track the line from Montreal eastwards. Bids were, accordingly, called for on designs prepared by the railway company's engineers, and a contract was subsequently entered into with the Dominion Bridge Company for the removal of the old spans and the erection of the new. A contract was also made with The Foundation Company for the extension of the substructure to accommodate the extra steelwork. In the old structure there was no traffic to be taken care of, but in the new it was not allowable to interfere with the regularity of passing trains. This considerably complicated the problem, and, under the circumstances, it was decided that the only possible way of ensuring all the requirements was to build two independent single track bridges, and remove the old bridge in sections, transferring traffic from side to side, as will be described later.

Substructure

From observations during the life of the old bridge, it was noted that the ice of Lake St. Louis generally grounded on the Lachine side of the river in shallow water, and, after breaking up, floated under the Lachine end of the bridge in small pieces in a manner which did not seem to justify the existence of 4-240 foot spans between piers Nos. 3 and 7. It was, therefore, decided to bisect these spans by the building of new intermediate piers (Nos. 3a, 4a, 5a and 6a), and using 8-120 foot spans instead of 4-240 foot. This resulted in considerable economy in cost. Between piers Nos. 7 and 11, it was not considered advisable to make a change. With these exceptions, the structure

*Abstract of paper prepared for the Canadian Society of Civil Engineers.

more economical than any other. These spans are of the subpanelled Pratt Truss type, and the top chords are curved, as far as possible, to an approximate parabola. In the web members, solid web plates have been largely used instead of lattice bars. In addition to this, the vertical posts are all of "I" sections, composed in most cases of bulb angles and web plates, and, where necessary, there are stiffeners on the webs especially of the longer vertical posts. The top and bottom chords are of very stiff cross-section, partly to allow them to be cantilevered out during erection. The 408 foot spans were also calculated for the stresses caused by the special method of cantilevering and launching, which will be described later. The portal and other subsidiary bracing is generally of a stiff design, consistent with the main trusses, to which it is attached. The 270 foot spans were also calculated for the concentrated weight of one end of the 408 foot spans, which was to be carried upon them during the process of launching.

The alignment on the bridge is ruled by the overall width of the 408 foot spans. At pier No. 11, and the south abutment, the two single track bridges are 27 feet, centre to centre, and from pier No. 11 to the north abutment the spans grow closer together till they are 16 feet 4 inches at the north abutment. This slight kink in the alignment is quite immaterial from an operating point of view, and allowed a valuable saving in masonry from pier No. 11 northwards.

Erection

One of the most important problems in the work was the maintenance of traffic during the erection of steelwork. There were on an average 10 trains between the hours of 8 a.m. and 12 noon, and sometime an average eight in the afternoon during the usual working hours. In order to carry out the work without interference with traffic, it was decided to erect first, all spans on the downstream side from the north abutment to pier No. 7. When this was done the two new 120 foot spans between piers No. 6 and No. 7 were moved bodily into the location of the old 240 foot span, and the latter moved upstream upon timber towers prepared for it. The downstream new spans between piers No. 6 and No. 7 were then erected. Traffic was now diverted over the four new spans between piers No. 6 and No. 7 by means of a cross-over laid on suitable wooden ties spanning from span to span, so that all old spans between pier No. 7 and the north abutment were thus released. These were taken down, and new spans erected.

Next, the new spans on the downstream side between piers No. 7 and No. 11 were erected.

In order to release some more upstream spans, it was simply necessary to slew over the 240 foot span between piers No. 10 and No. 11, all new spans between the north abutment and pier No. 11 now being under traffic and all old spans between these points being released. After the new spans on the upstream side between the north abutment and pier No. 10 had been erected, it was simply necessary to pull span No. 10-11 into alignment, and thereby put the traffic on all new spans between the north abutment and pier No. 11, the old spans between pier No. 11 and the south abutment being still under traffic. Then spans were erected between piers No. 10 and No. 11, No. 11 and No. 12, No. 14 and No. 15, and No. 15 and south abutment. After these were finished, the 408 foot downstream spans were erected on top of the 270 foot spans.

The *modus operandi* in connection with these 408 foot spans constitutes one of the most interesting features of the work. The scheme was to launch the span endwise with its rear end supported upon an ingenious truck or buggy, while the forward end was supported on a large scow of special design.

In order to avoid overstraining the adjacent 270 foot span by the concentrated loads of the sliding gear, an ingenious framed structure was devised by which it was possible to so distribute the end reaction over the floor system of the carrying span, that no part would be strained over allowable units. A diagram of this truck or buggy is shown on Plate No. 4, from which it will be noted that the secret of the construction lies in the fact that there is no vertical tie inside the triangulation but, in its place there is an exterior strut, which by reason of the proportions of the members, carries a reaction which is equal to the reaction at each of the outer ends of the triangulation. Thus, there is a three point bearing with equal reactions. The skidways consisted of eight 100-lb. greased rails (2 sets of 4), on which cast steel skids or slippers were imposed. The scheme was to move the span forward until it came to the last panel of the 270-foot span, where, of course, the front bearing of the three would naturally tend to pass overboard. In order to satisfy all conditions, the two outer bearings were here abandoned, and the span wedged up on the centre bearing only. The whole reaction being thus concentrated on one point required the end panel of stringers in the 270-foot spans to be reinforced. Details of this floating operation will be referred to later. The 120-foot spans were erected by means of a temporary span. The 240-foot spans were erected by the same 120-foot temporary trusses supported upon a wooden pier in the centre, as shown, between piers No. 7 and No. 8, and in the photographs.

The 270-foot spans were erected by these same 120-foot temporary trusses supported on a temporary tower about 30 feet wide, the only falsework at any time in the river being the towers as shown, and at no time was railway traffic placed upon the temporary falsework. This was required by the Railway Company from the beginning of the work.

The four 408-foot spans were alike in weight and general characteristics but, two methods differing somewhat in detail, were used in launching them. The two downstream spans were launched on the same set of carrying scows, but with a pilot scow upstream to take up the slack in the cables and to otherwise control the movement of the spans during launching. The experience gained in launching the two downstream 408-foot spans led to the abandonment of the pilot scow for the placing of the upstream spans. Under this arrangement the new spans were allowed, while travelling, to rub along a specially prepared vertical skidway bolted to the lower chords of the downstream spans already in place.

The carrying scow was really composed of two independent scows with two 100-foot deck plate girder spans (4 girders) placed on them, to equalize the load over the two scows. On these equalizing girder spans were erected a stiff timber tower on which the span itself was carried.

Anchors, each composed of concrete blocks securely strung together, weighing approximately 76 tons out of water or 52 under water, were placed about 1,500 feet upstream from the bridge, and generally respectively in line with piers No. 12 and No. 13, but on the land above pier No. 14 a "dead man" was used

composed of an "I" beam embedded in the rock. On the main carrying scow a dynamometer was inserted in the reaving of a fourteen roped tackle which was attached to the main anchor line, in order to record the pull on the anchor ropes. The readings taken from this dynamometer fully corroborated experiments which had previously been made regarding the resistance of floating bodies to the current in the river. They also agreed generally with Froude's formula

$R = fs \left\{ \frac{v}{6.9} \right\}$, see Fig. 2. The current in the river varied between 5 and 8 miles an hour, according to the location where the meter was used.

Details of Launching Operations

When all was ready, an ordinary Lidgerwood unloader, such as is used on railway work, was located and strutted in a position where a direct pull could be made from the drum of the engine. Communication was at all times maintained between the man in charge of the Lidgerwood engine, those in charge on the scows and the man in full charge of the operations, by means of a system of flag signals. The span was started by a number of jacks, after which the Lidgerwood engine controlled the whole of the movement and at no time was there any unexpected trouble. While the span moved forward the anchor cables allowed the anchor scow to float across the current with a radial motion. This necessitated the cable connecting the anchor scow with the main scows to be constantly shortened in order to maintain the true alignment of the span. As has already been stated, these anchor scows were used only in connection with the floating of the two downstream 408-foot spans. They were omitted when floating the upstream 408-foot spans, which were allowed to rub against the neighbouring spans already in position. The adjustment of the anchor cables was made as required.

The time occupied in the floating operations is extremely interesting:—

Span	Between piers Nos.	Date floated into position	Elapsed time h.—m.	Net time occupied in moving h.—m.	Total distance floated
Downstream					
408 feet...	13 and 14	Nov. 4/12	3—0	1—0	275 ft.
Downstream					
408 feet...	12 and 13	Nov. 22/12	2—30	28½	275 ft.
Upstream					
408 feet...	12 and 13	Sept. 18/13	1—30	22½	275 ft.
Upstream					
408 feet...	13 and 14	Oct. 6/13	2—0	16	275 ft.

Total weight of each 408-foot span while launching was 1,300 tons.

During each of these operations, all the regular trains of the railway company were allowed to pass on the adjoining spans, which necessitated stopping the floating operations because the work of signalling and superintendence, were interfered with. The difference between the net time and the gross, was occupied in overhauling cables, taking up slack, and in dismantling some of the steelwork connected with the special truck or buggy when it reached the last panel of the 270-foot span. At this point, it was necessary to remove certain steelwork which became no longer necessary on account of the load being shifted, from a 3 point to a 1 point bearing. A diagram of this buggy is shown in Fig. 1. The perfection of the control under which the span was at all times, is exemplified by an incident which occurred during one of the floating operations. The span had reached a point 3-

in. short of its correct location, and after the necessary signalling over the intervening distance of nearly 800 feet the Lidgerwood engine driver made exactly the 3-in. movement called for, no more and no less. This is remarkable considering the tonnage being handled. As has already been stated, the 408-foot spans were skidded upon the deck of the adjacent 270-foot deck spans, and after each pair of the large spans (on one track) were floated into correct location they were at an elevation approximately 12 feet higher than their permanent levels. This required that they be jacked down to their correct bridge seat levels, which was done by means of 150-ton jacks and blocking, the end floor beams having been designed for this purpose as were also the end cross beams of the 270-ton spans. The 240-foot spans were also provided with special end bracing to enable them to be jacked up on the piers, if necessary, during erection.

The time occupied in erecting the steel is as follows:—

March, 1911.....	Erection started at north end.
May 28th, 1911.....	New 120-foot spans moved into upstream alignment replacing old 240-foot span between pier No. 6 and No. 7.
July 6th, 1911.....	Traffic diverted to downstream track between piers No. 6 and No. 7.
Nov. 12th, 1911.....	New downstream span between piers No. 10 and No. 11 slewed over, thereby releasing old spans between piers No. 7 and No. 11.
March 31st, 1912....	Spans Nos. 10-11 moved into upstream alignment allowing erection to proceed on downstream spans Nos. 10-11.
June 18th, 1912.....	Spans Nos. 14-15, and 15-south abutment erected.
July 13th, 1912.....	Downstream spans Nos. 10-11 and Nos. 11-12 erected.
Nov. 4th, 1912.....	Downstream 408-foot span Nos. 13-14 floated.
Nov. 22nd, 1912.....	Downstream 408-foot span Nos. 12-13 floated.
April, 1913.....	Started taking down old spans between pier No. 11 and south abutment.
June 10th, 1913.....	All old steel dismantled.
Sept. 18th, 1913.....	Upstream 408-ft. span Nos. 12-13 floated.
Oct. 6th, 1913.....	Upstream 408-ft. span Nos. 13-14 floated.
Nov. 4th, 1913.....	All new steel erected and double track put into service.

The total weight of metal work in the old bridge was about 4,100 tons, in the new it was 14,231 tons.

The total quantity of masonry and concrete in the original piers and abutments was approximately 12,400 cubic yards.

In the additions to old piers and in new piers there were 13,300 cubic yards.

The total length of the bridge and height above watermarks were not changed, and are indicated on the plates.

The number of rivets in the new bridge is approximately 3,500,000.

As far as can be ascertained from the records, about 3,500 cars were used in transporting stone and steel to the bridge. These cars would, if placed in a single train, extend over a distance of 21 miles.

One of the noteworthy performances during erection was the speed with which the five old spans between pier No. 11 and the south abutment were dismantled and the new spans erected. This was done between the dates of April 22nd and October 31st, 1913. That is to say, 4,000 tons of steel were handled

in six months, or, 666 tons per month, and this without interrupting the railway company's traffic.

During the work, one man was drowned from one of the scows engaged on the substructure and one man was killed in Highlands Station Yard; but, during the erection of the steelwork over the river proper, there were no fatalities, and one a few minor injuries to men.

The cost of the work was slightly under \$2,000,000.

In charge for the Foundation Company were Mr. John W. Doty as Chief Engineer, with Mr. W. B. Taylor as Superintendent on the work.

For the Dominion Bridge Company, Mr. G. H. Duggan was Chief Engineer, and Mr. F. P. Shearwood, Mr. James Finley and Mr. David Bell were in charge of the design, superintendence and erection respectively.

For the Railway Company, Mr. J. M. R. Fairbairn was Assistant Chief Engineer, Mr. C. C. Schneider was connected with the work as Consulting Engineer, and for the design and approval of all detail plans the writer was responsible, as Engineer of Bridges for the Railway Company.

This record of the rebuilding of this work should not be concluded without referring to the place it occupies among the world's more important bridges. At the time of the erection of the first bridge, recently removed, the work was considered a remarkable example of the creative skill of the engineer. To-day the old structure, in view of the experience of the last twenty years, would be considered an achievement of only average rank. The new structure is no world's wonder as far as design and details are concerned, but, in view of the fact that there are recorded only a few instances, probably not more than eight, where large spans have been erected by the end-launching method, it is worthy of note that the work just completed includes the erection of no less than four large spans by this method, in what may be regarded as record time, and without a mishap of any kind. This is an accomplishment, of which the members of this Society need not be ashamed, and which further goes to show that, while our great profession knows no national bounds, it is not necessary to go outside this country to find men fully qualified to harness the great forces which exist in nature for the use and convenience of man.

A rather uncommon sign has recently been built into a new concrete structure used as a garage at Clinton, Wis., the name of the motor company being cast in bold relief in the face of the building. Forms constructed on the ground with the letters reversed were lifted into place and the concrete poured during the construction of the masonry wall. There is no question as to the stability of the sign and it harmonizes in material and color with the lintels, sills and ornamental trim.

Reinforced concrete is in practically universal use in the Philippines for all new construction under government control. School buildings are designed in units to which additions are made as growth demands but are uniformly of concrete for floors, walls and foundations. The peculiarity of the typical building is that it stands on stilts, or rather piers of concrete which permit a free circulation of air beneath the building in order to carry away moisture. The government administration buildings are of similar construction except that in some of them stone columns are used.

Failure of Concrete Buildings

THE failure of concrete buildings is due to dishonest workmanship, and not so frequently to mistakes in design, according to Prof. Ira H. Woolson, consulting engineer of the National Board of Fire Underwriters, in his remarks before the Round Table Order of the Insurance Society.

Prof. Woolson referred to the two general types—one the reinforced concrete building, and the other the steel skeleton structure building with reinforced concrete used for the floors, etc. He said the Bush Terminal building and the Gair building in Brooklyn are samples of the reinforced concrete type, while many other large buildings in New York City are of the fire resistant steel skeleton structure type in which concrete is used largely. The best features of concrete construction are that such buildings are both fire resistant and water resistant. They are strong and rigid and can be constructed at a moderate cost. No kind of construction gives greater rigidity at the same cost as reinforced concrete.

Prof. Woolson told how about 80 tests had been made principally in the East of concrete construction, and he had been present at half of them. The first fire test was made in September, 1896, and the material was tested for six hours. At the present time the standard test is four hours, with an average temperature of 1,700 degrees Fahrenheit. These tests prevail in Chicago, Philadelphia, New York and other cities.

Fire tests of columns had been very difficult heretofore, and small columns, viz., 8 or 9 inches diameter, had furnished the principal tests. The Underwriters' Laboratories in Chicago is building a huge furnace at a cost of about \$15,000, which will permit the adequate testing of concrete columns and with the idea of determining the load which they can carry.

Prof. Woolson discussed the necessity for proper mixing of concrete in order to get the best results. The concrete should be made rich and dense, and plenty of cement should be used. There are a few notable cases where, perhaps, the collapse of concrete buildings was caused from defective design.

Owing to the fact that concrete does not show its weakness after it is once hardened, he said, it is necessary that the various stages be carefully inspected, as dishonest work and the use of inferior materials not up to the specifications have been found to be the cause of most of the failures of concrete buildings.

The careless placing of steel reinforcement in floor slabs or in beams weakened concrete construction. He said he could not lay too much emphasis that good and intelligent workmanship is necessary to make concrete right. As soon as the builder attempts to economize in his materials trouble will begin.

The danger of prematurely removing the wooden molds was also emphasized. Prof. Woolson said there is no definite rule for the time for removing the forms, but the setting of the concrete and experience alone will determine this. Frozen concrete frequently collapses when the ice in it melts, and this disintegrates the material. The overloading of new concrete is a particular detriment. Frequently before the floor arches are properly set the building contractors dump heavy loads of building material upon the newly made floor. This tends to weaken the structure.

Concrete is often ruined, he said, because a poor grade of sand is used, while frequently a poor grade of cement, or not enough of it, likewise causes collapse.—Concrete Age.

Lay-Out of New Water Supply System for the City of Victoria, B.C.

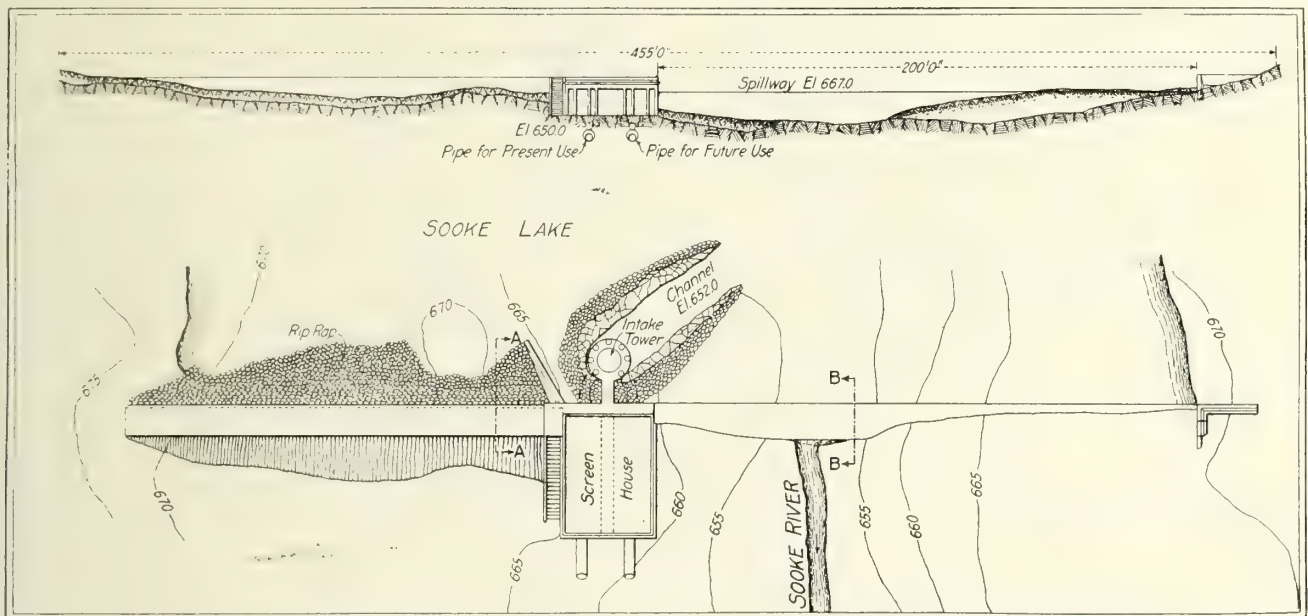
VICTORIA, the capital city of British Columbia, situated on the south end of Vancouver Island, had its first water system installed in 1868, when a private company pumped from wells and delivered through wooden pipes, making a charge of 0.75 cent per gallon. In 1872 Elk Lake was first studied as a possible source of supply and was rated as capable of furnishing 25 gal. per capita per day for a population of 90,000. As later constructed by the city, the Elk Lake supply, after passing through open gravity sand filters, was delivered to the city in low and high-pressure zones by a gravity system.

The necessity for increased supply and for greater fire pressure led to the installation of a pumping plant in this system, and when the daily consumption reach-

projects considered seemed to be to reservoir Sooke Lake for a 12-ft. lift of water level and lay a 40-in. concrete pipe on a slope of 1 in 1,000 to an artificial lake known as Humpback reservoir and located about 10 miles outside the city. The pipe is to be laid on the surface and the route traversed between the two reservoirs is 27.3 miles long. From Humpback reservoir a 36-in. steel pressure main will lead to the Smiths Hill service reservoir, which is located in the city at an elevation of 213 ft. above sea level and has a capacity of 16,000,000 Imp. gal.

Preliminary and Location Surveys

On July 1, 1911, when the city decided to take up active work on the extension of its water supply, there were no hydrographic data or maps in sufficient detail to decide any of the engineering questions at issue.



Plan and section of Sooke Lake Dam, showing intake channel and pipe connection from screen house.

about 2,000,000 gal. the lake level was lowered thereby and the quality of the water impaired. At this time Victoria West was supplied by water purchased from the Esquimalt Waterworks Company, a private corporation which owned rights on the Goldstream Lakes.

Water Rates

About 5,000,000 Imp. gal. were supplied to the city of Victoria in the dry months of 1913, the maximum daily rate per capita during these months being about 80 gal. The water taken from Elk Lake costs the city about 2 cents per 1,000 Imp. gal., while the price of water from the Esquimalt Waterworks Company is fixed by charter at 6 cents per 1,000 Imp. gal. The latter rate was considered excessive, as was also the price which the company asked for its holdings, and in June, 1912, after the proposition of an additional water supply had been under consideration for several years, it was decided to construct a supply system from Sooke Lake to the city.

The most practicable scheme among the various

Gaging stations for rainfall and rated sections on the Sooke and Leech Rivers were established at once, while engineering parties proceeded with a contour survey of Sooke Lake, running traverses of the various pipe lines that had been under consideration and determining the areas of the Sooke Lake and Leech River watersheds. These surveys were through thick forests of Douglas fir and over very rough country. Often precipitous rocky bluffs, difficult of access for work or for the transportation of supplies and equipment, delayed the progress, and since the work extended into the winter, working conditions were very trying. The time at which it was proposed to submit the project to popular vote necessitated expeditious work in order to get even the preliminary surveys in shape for the general plans and specifications. This was accomplished, however, and tenders of contractors were received December 15, 1911.

In the work of adjusting a gravity grade location for the concrete pipe the same difficulties of dense forests, rocky bluffs and a winter season had to be con-

tended with. Surveys and locations closely followed the methods used in railroad work. No angles of more than 3 deg. were used at the joints, and concrete pipe was assumed to be in 4-ft. lengths, while the steel pipe was considered as being in 22-ft. lengths. The road-bed for the concrete pipe, which was generally in side-hill work, was staked for an 8-ft. width. Tile pipe was laid for drainage openings, steel bridges were designed for the siphon crossings, and reinforced concrete trestles for the wide drainage openings and approaches to the bridges.

Sooke Lake

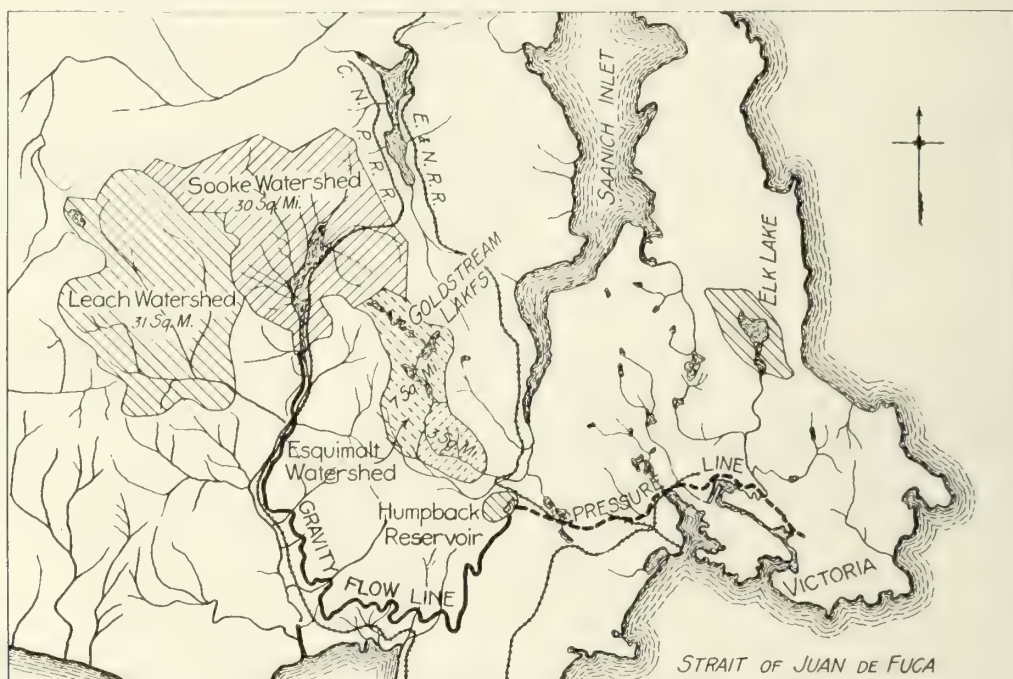
Sooke Lake lies to the northwest of Victoria, about 18 miles distant as the crow flies. It is about 4 miles in length and $\frac{1}{2}$ mile wide at its maximum width. Two narrows divide it into practically three lakes, of which the upper and largest has a maximum depth of 150 ft. Its main feeders are Ferguson Creek on the east side and a very large spring directly opposite on the west shore, which supply a total of about 3 sec.-ft. in the driest seasons of the year. The area

a reservoir capacity, above low-water level, of 3,355,000,000 Imp. gal.

The provision that the margin of Sooke Lake should be cleared to 15 ft. above low water affected 300 acres of thick forest, which had to be cut down and burned. About 2 miles of wagon road along the lake shore had to be built at this high-level elevation, and it was provided that the Canadian Northern Railway should build its proposed line at an elevation 50 ft. above low water, to admit of the ultimate project to reservoir the waters of the Sooke and Leech River watersheds to a height of 45 ft. above low water.

Intake and Dam

At the dam the intake channel is excavated 4 ft. below low water, and there will be an intake tower controlled by seven sluice gates, three 30 x 42 in. and four 24 x 30 in. The gate openings will be protected by bar screen cages anchored in the concrete. From the intake tower two 40-in. riveted steel pipes will be laid to conduit the water to the screen house, but only



Map of watersheds, reservoirs and pipe lines for Sooke Lake supply.

of the lake at low water, which is 555 ft. above sea level, is 964 acres, and the total watershed area is 31.33 sq. miles. This watershed, rising in places to more than 2,500 ft. in elevation, is densely wooded with Douglas fir, and except for the narrow flat around the lake shore has a steep slope of precipitous bluffs of trap rock. It is bounded on the east by the Leech River watershed, 30.33 sq. miles in area, and joins the watershed of the Esquimalt lakes on the south.

In the scheme for the ultimate development it is proposed to utilize the Leech River water supply by building a diverting dam in the stream and a 5-mile conduit to convey water to Sooke Lake. When this is done a dam rising to a height of 45 ft. above the present low-water level of the lake is projected, and it is estimated that a daily flow of 100 sec.-ft. will be available, while the reservoir storage above low-water level will be 17,358,000,000 Imp. gal. The initial project now under way, by the use of a concrete dam at the outlet, will raise the lake 12 ft., and this will give

one of these will be put in service at present. In the screen house will be installed a set of twelve screens with a mesh of 40 openings to the inch. Below these are the measuring weir and cascade steps to the conduit pipe at a grade elevation 12 ft. below the low-water level of the lake. The screen house will be of concrete with a concrete roof and windows protected by wrought-iron grillages. A sink will be provided with water under pressure from a 6,000-gal. tank for washing the screens.

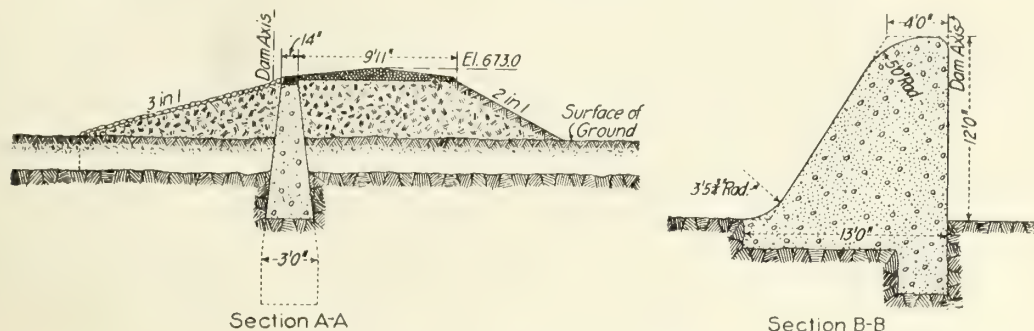
The dam will be a composite structure, the west end being an earth embankment, with a concrete core wall bonded into the natural rock. Then comes a reservoir section wall with a screen house at its back. From the screen house to the east abutment an ogee weir section 200 ft. long will be used, which is generally about 15 ft. above the foundation of natural rock. This will be bonded into the rock with a cut-off trench at the upstream face. About 2,200 bbl. of cement will be used at the site, which will have to be hauled 9

miles from Fitzgerald's station on the Esquimalt & Nanaimo Railroad.

Concrete Pipe Line

A consideration of the three alternative bids on wood-stave, riveted-steel and reinforced-concrete pipe resulted in favor of the last-named type, largely on account of its permanency and economy. The initial

reach the pipe in falling. It is not proposed to cover the pipe except in the deep cuts where slides might occur. At each 2,000 ft. point on the conduit line there will be an open standpipe, and all inverted siphons will have waste outlets at the bottoms controlled by 6-in. gate valves. All inverted siphons are to have steel reinforcement, varying in quantity accord-



Earthfill and concrete ogee sections of dam.

development is being carried out with a single pipe line, 40 in. in diameter, which is to give a daily supply of approximately 16,000,000 Imp. gal., this being calculated as sufficient for at least 200,000 people at Victoria's present rate of consumption. The flow in the pipe was estimated for $C = 120$ in the Chezy formula, or $n = .012$ (about) in Kutter's formula.

The reinforced-concrete pipe is designed with a 40-in. inside diameter and a 3-in. thickness of walls. The reinforcement will be wire mesh with an area of 0.043 sq. in. per foot of pipe and a 0.025 sq. in. sectional area of cross wires per foot. The pipe, which will be built up along the line in 4-ft. lengths, is to be of the type patented by the Lock Joint Pipe Company, of New York.

As no materials suitable for making concrete occur along the grade, it will be necessary to establish a pipe yard where these can be made. The finished pipe will then be hauled up an incline railway to the grade and conveyed to the desired point by the construction railway on the conduit roadbed, which will also be used in the erection of the various drainage structures. The pipe will be leveled to grade and supported upon crushed-stone ballast.

A right-of-way 100 ft. wide was secured for the pipe line, and all trees in this strip were cut down, as were also all high trees outside this strip which might

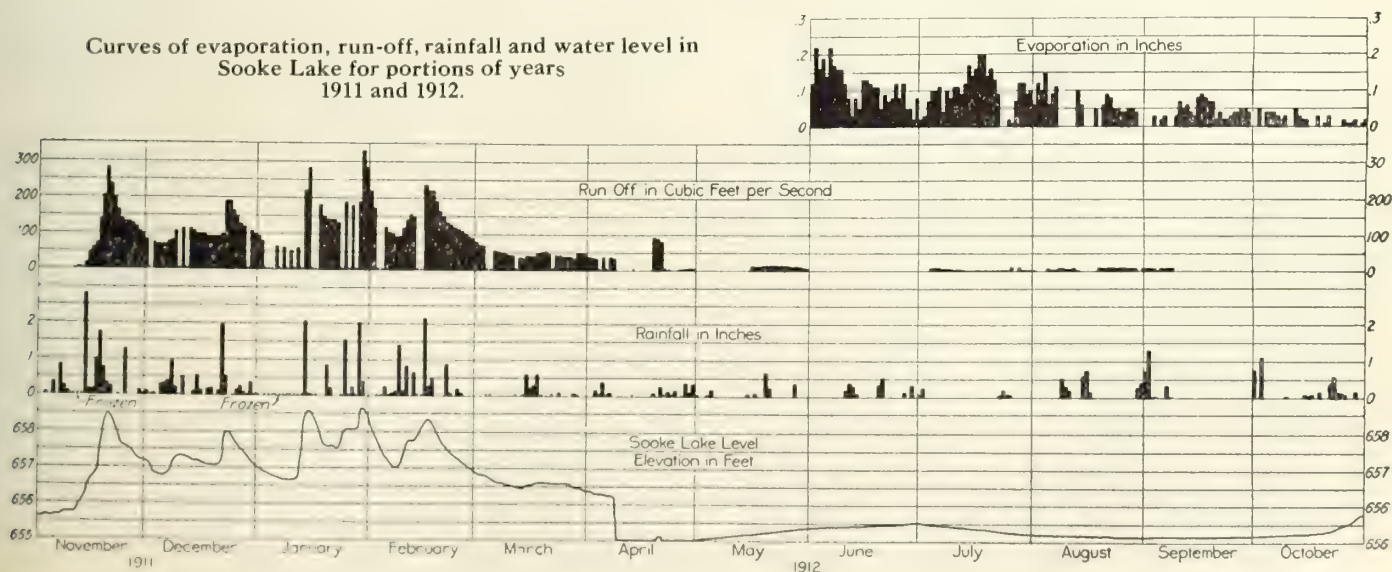
ing to the head. Anchorages and expansion joints are specified where necessary.

Drainage Openings

The drainage openings along the flow-line grade are of several varieties. For the smallest drainage the water will be carried along and passed under the pipe line by small holes through the ballast at points where the roadbed is in the rock. For a somewhat larger volume of water concrete side walls will support the pipe where the span requires it, and if the crossing is at a point where earthy material occurs it will be protected from scour by concrete. This refers to the shallow openings practically at grade; but where there is some embankment, vitrified pipe from 12 in. to 24 in. in diameter will be used; for a still larger volume, open ravine culverts of 15 ft. span with a concrete girder and saddles will support the pipe, while 45 to 80 ft. steel bridge spans with concrete abutments will be used to cross streams at low points of the siphons. Six siphons are required, and these will be laid to precise horizontal and vertical curves. The deepest siphon is 600 ft. long and has a maximum head of 90 ft.

One of the difficulties in connection with the project was to secure a reserve reservoir at the proper elevation and near the city. A suitable site was finally located on the Humpback Road, about $10\frac{3}{4}$ miles from

Curves of evaporation, run-off, rainfall and water level in Sooke Lake for portions of years 1911 and 1912.



Fountain Square in Victoria. This reservoir covers an area of about 40 acres, from which it was first necessary to clear a thick forest. The earth on the reservoir site is a black soil of a peaty nature, and it is proposed to cover this with a 6-in. layer of clean sand and gravel, to act as a diaphragm between the soil and the stored water.

Test pits were excavated on the site proposed for the dam and satisfactory rock foundation found. In the deepest part this was about 30 ft. below the valley floor. A concrete dam was planned here and is so located that with a maximum height of 60 ft. and a crest length of 600 ft. it impounds 136,000,000 Imp. gal. The dam contains about 8,000 cu. yd. of masonry.

A gate house with control valves and screens was provided at the dam and two cast-iron outlet pipes 34 in. in diameter were installed for delivery to the pressure mains, while a 16-in. cast-iron pipe will be used to discharge waste water.

On reaching the Humpback reservoir the water from the gravity-flow line will pass over a weir into a concrete chamber, from which there will be an outlet either by flowing over a stepped cascade, over concrete and rock into the reservoir (for aeration) or by a pipe with a submerged outlet, controlled by a butterfly valve. The pipe will taper from a 36-in. diameter to a 24-in. diameter in 20 ft. and will be used if there is a tendency for the water to churn milkv due to microscopic growths.

Riveted Steel Pipe

It is proposed to deliver the water from the Humpback reservoir to the city through a 36-in. riveted steel pipe. Delivery could not be made from the pipe direct to the city service system, as the pressure would be too great, so the water is allowed to overflow into Smiths Hill reservoir as a stand pipe. This is situated at the southern city limits at an elevation of 167 ft. below the water level of Humpback reservoir, or 213 ft. above sea level, while the average elevation of the city is, roughly, about 5 ft. above sea level. The elevation of Humpback reservoir will enable it to deliver later directly into the city's high-level system, which has to be served at present by pumping.

A consideration of tenders on riveted steel pipe and lock bar pipe for this pressure line resulted in a decision to use the former. There will be two thicknesses of plate—20,500 lin. ft. of pipe using plates 5-16 in. in thickness and 36,500 lin. ft. of pipe using $\frac{3}{8}$ -in. plates. This plate will be made by the open-hearth process, and the rivets are to be extra-soft steel, according to the requirements of the American Society for Testing Materials. The pipe is to be made in four-plate lengths, which will give sections about 22 ft. long. Each pipe is to be dipped in a hot bath (400 deg. Fahr.) of Pioneer mineral pipe coating, bitumastic, or their equal. Inside and outside courses are to be used. The riveting and spacing of rivets must produce a 70 per cent. joint. All rivets are to be driven by pneumatic or hydraulic-pressure machines in the shop and pneumatic hammers in the field. No angle will be permitted in any joint of the pipe line of more than 3 deg.

There are to be four concrete gate houses located along the line, with 36-in. rising-stem gate valves; 6-in. nozzles will be riveted to the pipe for the 6-in. gate valves which are placed at the bottom of all dips for emptying the pipe. Inlet and outlet air valves will be similarly attached to 4-in. nozzles on top of the pipe, the former to prevent collapse and the latter to prevent air binding at the summits. A Venturi meter with a

recording apparatus will be installed in a concrete house a short distance below the Humpback dam, with which an accurate record is to be kept of the water passing through the pressure main.

A contract for the construction of the entire work was made with the Westholme Lumber Company, of Victoria, in January, 1912, but this contract was abandoned by the company in April, 1913, and since then the city has proceeded with the project both by day labor and by sub-contract. A contract for the 27.3-mile gravity-flow line was recently awarded to the Pacific Lock Joint Pipe Company, of Seattle, Wash.

Wynne Meredith, of the firm of Sanderson & Porter, of New York City and San Francisco, was retained in July, 1911, as the consulting engineer for the city's water commissioner. Boyd Ehle is the present resident engineer at Victoria. James H. Raymur, as water commissioner, was the executive of the city of Victoria in charge of the project during the preliminary stages, and was succeeded early in 1913 by Charles H. Rust.—Engineering Record.

Freezing Process for Foundations

Cases sometimes arise where ordinary foundations cannot be constructed, either owing to the presence of quicksand, or to the fear that the driving of ferro-concrete piles would be prejudicial to adjacent buildings. The reconstruction of the foundations of St. Paul's Cathedral is thought to constitute a most difficult problem because excavations might cause disastrous results and pile driving is not desirable. The difficulty, however, could readily be overcome by the aid of the freezing process, permitting the necessary excavation to be made for ferro-concrete foundations, based on solid hardpan below the potter's earth on which the existing piers are carried, and underpinning the entire structure so as to make it safe for all time. The process has recently been applied with economy and general satisfaction in Berlin, where the foundations of a large building had to be carried 10 ft. below the foundation of the adjoining structures. As the latter were built on running sand, it was entirely out of the question to excavate for the new building without special precautions, and the freezing process was adopted. Freezing pipes of 5 in. diameter were sunk around the space to be excavated and connected by headers with a brine pump and tanks. Cold brine was pumped through 1 in. pipes enclosed in the 5 in. pipes, and the brine was returned to the tanks through the latter. When the apparatus was in operation the effect was to establish a stable barrier of frozen quicksand, permitting the foundation space to be excavated without difficulty.—Ferro-Concrete.

A new type of suction-dredge mouthpiece without any rotating element has been patented in Germany by Herrn Pieter von Wienen, of Hamburg. It has the shape of a square box, as shown in the accompanying drawing. Above the lower side is a bent plate forming a dam across the opening. In line with the back slope of this plate and above it is placed the inclined intake for water, this arrangement providing an efficient means for breaking up the dirt and giving a good mix. The amount of water is regulated from the dredge by a chain operating a flap valve at the pipe intake. An adjustable shield in the front of the box, supported on three struts running in guides and held in place by screws, serves to guide the material to the opening in the mouthpiece.

Deleterious Effect of Rust in Steel Highway Bridges

By Clifford Older*

INVESTIGATION of steel highway bridges by the Illinois Highway Commission indicates that few of these structures are ever painted after final completion and acceptance. Steel structures located in cities or near railways, rust rapidly if not properly protected from the gases produced by the burning of bituminous coal. This is particularly the case where bridges span railway tracks.

The fact that such structures cannot be neglected without danger of serious results is illustrated by a recent investigation of a pony truss bridge carrying an important highway over a railway. The floor planks were supported by wood beams placed at right angles to the roadway and resting on the outstanding legs of the lower chord angles of the trusses. Each lower chord was composed of two 4 x 5 x 1/2-in. angles. The floor planks were placed diagonally. The outstanding legs of the angles for a distance of about 3 ft. over the track were entirely destroyed by corrosion and the vertical legs were materially affected. It is likely that the dangerous weakness of this bridge would not have been discovered had it not been for the fact that the arrangement of the floor supports was such that two of the wood beams were left unsupported and finally fell to the track below. This bridge had been completed but five years.

In southern Illinois a peculiar condition exists which undoubtedly has a material bearing on the corrosion of steel structures. In that portion of the state popularly known as Egypt, a large proportion of the surface soil when tested, shows a marked acid reaction. This condition exists generally throughout the greater part of the state which lies south and east of the Kaskaskia River and south of the latitude of Mattoon. To a less marked extent, the soil is acid in many places elsewhere in the state where the land has been farmed for fifty years or more.

This acid condition does not exist for a depth of more than a few inches, and steel buried at a greater depth does not seem to exhibit any unusual tendency to corrode. The greatest effect is noticeable at, or slightly above, the ground surface and at other places where dirt may become lodged. Such accumulations of dirt are constantly being washed away by the rains and are again replaced by a fresh supply of the acid soil brought by the wheels of vehicles, the wind or other agencies. Wherever this acid soil accumulates readily (as it does about the shoes, stringers, floor-beams, lower chords, and elsewhere below the floor of the bridge), corrosion is very rapid unless the steel is kept well protected by paint or is incased in concrete.

Examination of many steel structures in the district mentioned has disclosed the fact that steel plates, angles, or the webs of channels or I-beams having a thickness of 1/4 in. or less, when exposed on both sides to the conditions mentioned, are completely destroyed by corrosion in from ten to twelve years. Examination of comparatively new structures seems to indi-

cate that the initial cost of paint affords protection for two or three years. The period of active corrosion is therefore probably not longer than eight or ten years.

Corroded channels were removed from a small bridge near Hillsboro, Ill., which had been in service only ten years. The original thickness of the web was 0.2 in. The position of the most rusted portion was about 12 in. below the floor of the bridge, where a shelf angle formed a lodging place for dirt which sifted through the cracks of the plank floor. The soil is markedly acid in this neighborhood. It may be seen that unprotected steel structures in this district may become dangerously weakened within a very few years. That many more accidents have not occurred is undoubtedly due to the fact that the country in general is poor and, until recently, wood has been largely used for highway bridges.

A peculiar effect of rust action has been observed a number of times during recent years. In examining steel bridges which have been erected for some time, it has frequently been noted that the edges of thin plates, such as the cover plate of a compression member, when riveted to the flanges of channels or I-beams, frequently show a wavy or scalloped appearance. Where this occurs, the plate near the rivets is in contact with the flange of the channel but between the rivets the plate is bulged out in some cases as much as 1/4 in., the space between the plate and flange being filled with dirt and rust scale. This condition is distinctly noticeable in case of the end post.

It was not immediately recognized that this buckled condition of thin cover plates was due to the expansive action of rust scale formed between the contact surfaces. That this is true, however, is evidenced by the fact that comparatively new structures do not show any appreciable buckling of thin plates between rivets, and it is inconceivable that faulty shop work should be responsible for the frequent appearance of this phenomenon in bridges built by many different shops and at different periods of time.

The volume of solid iron rust is approximately twice the volume of the metal from which it is formed and as rust scale is always more or less porous, thus still further increasing its bulk, the corrosion of a comparatively thin surface layer of each piece produces a sufficient bulk of rust scale to force the pieces apart, thereby causing the bending of the cover plate between rivets. This buckling of one of the component pieces of a compression member, of course, seriously reduces the capacity of that piece to take compressive stresses.

A remarkable instance of the expansive force exerted by rust scale was recently discovered when an examination was made of a bridge which spans Fox River at Ottawa, Ill. This structure has a single span of 234 ft., an 18-ft. clear roadway and a 7-ft. sidewalk outside of one truss. The trusses are really trussed parabolic arches having a center height of 26 1/2 ft. It was completed in 1869. The arch members are made of Phoenix sections, plates and channels. The web

*Bridge Engineer, Illinois Highway Commission, Springfield, Ill.

plate of the rib on the side carrying the foot-walk, was originally about $\frac{5}{8}$ in. thick, while in the opposite rib this plate was probably $\frac{3}{4}$ in. thick. The thickness of the metal of the Phoenix sections is about $\frac{3}{8}$ in. The various structural sections were connected by means of $\frac{1}{2}$ -in. rivets spaced 6 in. apart. Owing to the thickness of metal, width of flange and shape of the section, the flanges are very stiff.

A scale of rust about $\frac{3}{16}$ in. thick had formed on each side of the web plate, between the plate and the flanges of the adjacent sections. The expansive force exerted by the formation of this scale had ruptured practically all of the rivets connecting the upper and lower halves of the ribs from one end of the bridge to the other. A length of 10 ft. of one of the arch ribs had but one unbroken rivet.

In some cases the heads of the rivets were pulled off, but usually the break was in the shank. In a few cases the head was pulled off and the shank broken as well. Examination of the ruptured rivet ends indicated, by varying degrees of corrosion, that some of the rivets had probably been broken several years, while others exhibiting almost no rust, had undoubtedly been ruptured quite recently. Some of the broken rivets show an apparent reduction of area adjacent to

the break typical of a tension failure. There were no indications that this reduction was caused by rust. In cutting out the rivets, all indications pointed to a tough and ductile material.

A row of these rivets 5 ft. long was cut out and every rivet was found broken. The tenth rivet, however, was intact and when the head was cut off, a sudden jar was felt accompanied by a splitting noise, as the two halves of the arch rib separated appreciably for a length of 10 ft. or more. Right then the investigator, and others, indulged in an undignified scramble for solid ground. Nothing serious happened, however. It was found that not more than 10 per cent. of the rivets connecting the upper and lower halves of the arch ribs were unbroken. It is probable that friction and crooked shanks, due to mis-matched holes had held the parts together. There was strong evidence of a recent working of these joints. The surface steel of this bridge had been protected reasonably well with paint. Scraping disclosed a number of different colors.

Up to the present time it has been impossible to secure any material attention from local highway officials to the importance of keeping steel bridges well painted. It is hoped this matter as well as others of equal importance, may be provided for.

The Preservation of Structural Steel

By A. H. Sabin

CORROSION of structural metal (principally steel) by atmospheric and other natural causes is a subject which has long been of importance to the engineer. A few years ago, the greatly increased use of concrete structures aroused the hope that danger from such corrosion would be much reduced; but unarmoured steel seems to be used as much as ever. Concrete has not taken its place, but has made an entirely distinct place for itself. Much has been written, and much has been done, relative to the protection of steel; but improvement has been slow, progress being made step by step.

The writer can remember, when corrugated iron was introduced some thirty years ago, that it was common practice to send out with a shipment a suitable quantity of powdered iron oxide to be used as a pigment, with directions for mixing it with oil and applying it as a paint. It was supposed that, because it contained iron, it was a proper paint to apply to iron, like "applying the hair of the dog to cure the bite" (which the writer has also seen done).

Some years ago Mr. G. W. Thompson attempted to classify pigments, as to their relation with iron, by suspending them in water and immersing pieces of iron or steel in these mixtures. The results were somewhat surprising; some of the pigments which common experience approved seemed to increase corrosion in this condition, and others, known to be useless in protective paints, seemed to be much better for preventing it. Lampblack, for instance, was the worst in provoking corrosion, and white zinc or pulverised chalk prevented it. This was probably due to the fact that lampblack contains, condensed on the surface of its particles, considerable carbonic acid which is the most generally active agent in the corrosion of iron, and white zinc and chalk are basic substances by which iron is not rusted; however, the carbonic acid in lamp-

black is displaced by grinding in oil, and the well-known lack of durability in paints made of white zinc and chalk prevents their good qualities from coming into action.

So great is the need of more knowledge as to the value of pigments in paints and their mode of action that nothing promising new information is neglected. A committee of five chemists from different parts of the United States, with the approval of the Society for Testing Materials, made a series of tests of the principal pigments, and of some other substances, on steel immersed in water; and, as was to be expected, arrived at substantially concordant results. These results, as has been stated, were of no value from the standpoint of the paint maker, being inconsistent with the known value of the pigments when ground in oil or varnish. When the report was published, however, the pigments were classified, according to their water value, into three groups, namely, inhibitors, indeterminates, and stimulants.

This was the origin of the use of these now well-known words in paint terminology. It was expressly stated in the report that this was a classification as regards water only; but the names were so convenient and so tempting that those not familiar with the subject, and also many who saw their value for advertising purposes (two quite distinct classes), put them into common use to classify pigments in oil. It is obvious that any classification of pigments in oil should be based on their behaviour in oil, and if, as must be conceded, this is radically different from water tests, the latter should not be regarded. All this investigation began some years ago; meanwhile, numerous young men, mostly students working under the supervision of their teachers, have made brief and generally inconclusive studies of paints, and almost without exception have used these indefinite terms, inhibitors and stimu-

lators. Patents have even been taken out—which, in the writer's opinion, are not only worthless, but invalid—covering the use of old and well-known pigments. What is worse, every maker of a paint nostrum assures his hearers or readers that his particular paint absolutely inhibits rust, and that everything else stimulates it. This is the whole history of this jargon about inhibition and stimulation; it never had any particular value to the consumer, and it is generally used to mislead him.

It is obvious that in a good paint the pigment particles are enveloped in a film of oil; they do not come in contact with the iron; if they did, the paint would peel off, for no dry pigment adheres well to metal. It is as true to-day as it has been in the past that steel rusts because air and moisture act on it; and paints are used to keep air and moisture from it. They do not inhibit rusting, except as they inhibit the cause of it.

The Improvement of Paint

The important practical question is whether paints have been or can be improved as to being non-porous and durable. This is essentially dependent on the relation between the pigment and the oil. As to the true nature of this relation, very little is known; but something is known about its visible manifestations. It is known, for instance, that 1 lb. of dry red lead mixed with $\frac{1}{4}$ lb. of oil makes a paint of ordinary consistency, and 1 lb. of dry lampblack requires at least 6 lb. or 8 lb. of oil, say, thirty times as much, or, making allowance for difference in density, six times as much, as the red lead. Similarly, 1 lb. of white zinc takes twice as much oil to make a paint as 1 lb. of white lead; and white lead takes nearly twice as much as red lead. These are things we know; but we have no idea why they are so.

Again, red lead, which is an oxide of lead, makes an excellent paint for iron; oxide of iron is neither very good nor very bad; oxide of manganese is bad. Our knowledge of paints is as yet largely empirical; chemists dislike to admit this; for, like everybody else, they hate to confess that there is anything they do not know, and thus when a new theory is offered some of them make a great rejoicing over it without first finding out whether or not it agrees with the facts. Where we are gaining is in more general appreciation of the value of the proper application of paint, better preparation of surface, more confidence in good paint rightly used, and in the better preparation of paint materials. For instance, in the older books, and until about twenty years ago, we find analyses of red lead showing as low as 55 per cent. of true red lead, with 45 per cent. of litharge. Red lead is made from litharge, and the presence of the latter is not a sign of adulteration, but of incomplete conversion. At the same time other samples showed as high as 80 per cent. of true red lead. As is well known, there was much difference of opinion in those days as to the value of red lead as a paint for iron; though most users liked it, some thought it poor stuff. It is now known that its value depends on the quantity of red lead it contains. Coarse red lead always contains litharge, because the litharge in the middle of a large particle is never oxidized. It was observed that the finer the red lead the better it was, and so a demand arose which forced the manufacturers to make higher grades; now they are grinding their litharge to an impalpable powder before roasting it, with the result that 94 per cent. of true red lead has been on the market for some years.

Then an unexpected fact was developed. The old

red lead when mixed with oil would set in a day or so—often in a few hours—into a cement, just like plaster of Paris and water; this tendency made it work with difficulty and unevenly in application, and its coarseness gave it a tendency to run; but the new, or high grade, article is inactive to oil, and brushes out smoothly like a house-paint. This enables the painter to cover 50 per cent. more surface with the same quantity and still get a coating having a uniform thickness which gives more protection than the thin portions of the paint formerly used. This secures greater economy, even at a slightly greater cost per gallon; and this is an economy not only in the cost of the paint, but in the labour, because the paint works more easily, and a man can cover more surface in a day; it also requires less skill, and therefore a less highly paid man, to do good work.

For the last year or two, red lead ground in pure linseed oil has been offered to the trade as a paste ready to be thinned with more oil; such a paste keeps for a year or more, or indefinitely as far as known, like white lead paste. Its use saves time and waste in mixing, and, being ground through a mill, the mixture is perfect, which is not the case with hand-mixing; and, as it avoids the presence of a dusty pigment, it is more sanitary.

The only serious objection to the use of such red lead is that it dries more slowly than the older kinds. This can be obviated, however, by the use of a little japan drier. There is a well-founded prejudice against the use of excessive quantities of drier in any paint; but it should be remembered that red lead paint mixed in the (standard) proportion of 28 lbs. of pigment to 1 gal. of oil, contains $20\frac{1}{4}$ lbs. of pigment per gallon of mixed paint. If this pigment contains 15 per cent. of litharge, it has 3 lb. of litharge per gallon. Now, ordinary, good, lead japan driers, or lead and manganese driers of approved quality, contain the equivalent of 1 lb. of litharge in about 3 gals. of drier; and 3 lbs. of litharge will make 8 or 10 gals. of drier. To make 1 gal. of mixed 94 per cent. red lead paint dry requires only 1 pint of drier; the rest is excess. It is much safer to add the desired quantity of drier. It may be asked why the litharge in the 94 per cent. red lead is not more active; it is probably because, when the peroxidation of the lead has been carried so nearly to completion, the particles of litharge are enveloped so completely by a dense coating of true red lead that the oil does not reach them. This is obviously not the case with the commoner and less thoroughly oxidized pigment.

It has sometimes been suggested by those not very familiar with the chemical questions involved that the litharge is the essentially valuable part of the paint, and that the red lead is only an inert extender. This is not so. The whole history of the subject shows that the improvement in red lead for paint during the last twenty-five years has been made by reducing the litharge contained in it; litharge alone, or used with other pigments, has not been satisfactory, though orange mineral, which is red lead free from litharge, is most excellent, and would be used if its cost were not so great. Further progress will undoubtedly produce red lead with a lower percentage of the protoxide; in fact, the 94 per cent. red lead now in the market usually contains much more than 94 per cent. of true red lead.

Mr. Walter S. Allward, the well-known Toronto sculptor, has received an invitation to enter a competition for the best plans submitted for the proposed Dollard Monument to be erected in Montreal.

Refuse Disposal Practice in Canadian and U. S. Cities

IN a report made recently by Messrs. Hering & Gregory, consulting engineers of New York, to the commissioners of Trenton, N.J., regarding recommendations for the collection and disposal of the city refuse, there are some interesting conclusions based upon the latest advancement in the science of refuse disposal. These also include an interesting reference to incineration plants in Canada and the United States. From the report we reproduce a few extracts concerning the functions of these incinerators.

The first furnace in America, which has not only given complete satisfaction, both from a sanitary and economical point of view, but has also utilized the heat created by the burning, is the one which was constructed in 1906 and has since been operated at Westmount, a large suburb of Montreal. It is situated not far from the residences and other buildings, burns all kinds of refuse and supplies heat for generating electricity which assists in lighting the town. As first built, the incinerator had only one furnace, having a capacity of burning 50 tons of refuse per day; the operation of this furnace was so satisfactory that a second furnace has since been added. The cost of incineration at this plant, including fixed charges, is about 52 cents per ton of refuse. Other incinerators and the years in which they went into operation are: Vancouver, 1907; Seattle, 1908; West New Brighton, 1908; Milwaukee, 1910; Clifton (Richmond Borough, N.Y.), 1912; Atlanta, Ga., 1913; Paterson, N.J., 1913, and San Francisco, 1913. The West New Brighton and the Clifton plants are both in Richmond Borough, the latter being built after the former had been found to give excellent results, and embodying some improvements. The largest refuse incinerator in the United States is that at Milwaukee, which has a capacity of 300 tons of mixed refuse per 24 hours and cost, exclusive of the land, \$212,000. This has been operating for three and a half years, and a careful investigation showed that during the first three months of 1911 the total cost of operation, including interest, depreciation, etc., was \$1.65 per ton. The high cost is said to be due mainly to hand operation, and it is believed that the cost could be reduced to \$1.30 per ton. No funds were provided at first for the necessary equipment to produce power from the steam generated at the incinerator or to crush the clinker. Recently, however, a power plant has been constructed and completed in which electric current will be generated for operating the two stations which pump water for flushing the Milwaukee and Kinnickinnic rivers.

One of the latest refuse incinerators built along still more favorable lines is in the city of Montgomery, Ala., and has been operated since July, 1911. It consists of one 60-ton furnace of four grates with hydraulically-operated top feed doors. The refuse is mixed, consisting of garbage, rubbish and ashes, and is dumped from the collecting carts directly into storage hoppers immediately above the containers which feed into the top of the furnace. The clinkering is done by hand. The clinker falls into a car which is removed and automatically dumped by a hoisting engine and then returned. The labor has been reduced below that required at Milwaukee because of the machine feeding and clinker removal. At Paterson, N.J., and

Atlanta, Ga., still greater improvements have been made which have materially reduced the amount of labor and consequently the cost of operation.

Both in Europe and in the incinerator already in operation and the second one now under construction in San Francisco, as well as in the incinerator nearing completion in Savannah, Ga., substantial reductions in operating costs are either being secured or expected.

The largest incinerator on this side of the Atlantic is that in Havana, Cuba. This incinerator was completed in February, 1913, and has a capacity of burning 500 tons of mixed refuse daily.

Describing the process of reduction, the report says: The garbage, which for this purpose must be collected separately from the rubbish and ashes, is placed in closed tanks, called digesters, and cooked for several hours under steam pressure. The cooked material is then withdrawn from the digesters and pressed to remove as much as possible of the liquids. These liquids, which carry roughly about two-thirds of the total amount of grease in the garbage, then flow to separating tanks in which the grease rises to the surface and is withdrawn. The remaining liquids, in many of the reduction works, are then allowed to go to waste, but in other works they are still further treated to recover valuable ingredients which are in solution. The pressed material, called tankage, which still contains a considerable amount of moisture, is dried to remove as much of this moisture as possible and then screened. Dry tankage thus produced is a marketable product and is used as a base in the manufacture of fertilizers.

Tankage which has been simply pressed and dried generally contains some grease, owing to the fact that it is impossible to remove all of the grease by simply pressing. The grease contained in the dry tankage can, however, be nearly all recovered by the use of the naphtha process. This process consists of placing the dry tankage in closed vessels, called percolators, and then allowing the naphtha to percolate through the mass, the naphtha acting as a solvent. The naphtha with the dissolved grease is drawn off and flows to a treating tank in which it is heated to vaporize the naphtha and recover the grease. The naphtha is recovered by condensing it in a separate vessel.

Where it is desired to extract valuable ingredients in the liquids removed from the separating tanks mentioned before and from which the grease has been separated, the liquids are carried to evaporators in which a large amount of the liquid is evaporated, leaving a syrup. This syrup is then withdrawn and mixed with the tankage, which may or may not have been treated by the naphtha process, after which the tankage is dried to remove the moisture added by the syrup. Tankage thus produced is of better quality and commands a higher price.

A. D. Masson, of 30 St. Nicholas street, Quebec, dealer in contractors' supplies, has recently added a structural steel department and is now fully equipped to supply all kinds of constructional material. Recently he secured the contract for the structural steel work on the new Quebec civic hospital now in course of construction.

Structural Features of the Ryrie Building, Toronto Adapting a New Extension to an Old Building

(Staff Article)

THE new Ryrie building at the corner of Yonge and Shuter streets, which has just been completed for the owners, Messrs. Ryrie Brothers, makes a notable addition to the commercial building of Toronto. The original building on the north side of the present structure had a frontage of 77 ft. on Yonge street and a depth of 120 ft., being four storeys high with basement. This building was of so substantial a character that it was deemed unnecessary to pull it down. The design, therefore, was simply taken as the standard for the new building. The result is a substantial structure which occupies commanding space on Toronto's leading down-town thoroughfare, having a frontage on Yonge street of 60 ft. and a depth of 122 ft. on Shuter street. The building is of five storeys with basement, another storey having been added to the original structure, thus making the whole block uniform in height as well as in architectural design. The old structure suggested the Italian design of architecture, therefore the aim of the architects was as far as possible to carry that atmosphere through the entire building. In a city that promises to possess so many buildings of the skyscraper type, the new Ryrie building is a pleasing variation and should add to the commercial features of Toronto. In evolving the scheme the idea of Ryrie Brothers was to erect a block where a high standard could be maintained in regard to choice of tenants, and the conditions in this respect will be such that as far as possible everything will be uniform in the way of signs and so forth.

Layout and Equipment

The building consists of stores running round the entire ground floor. There are two entrances from Yonge street, the main entrance being through a spacious vestibule to the staircase and elevator lobbies. The second, third, fourth and fifth floors are laid out as office floors, provision being made for division into a maximum of sixty-five offices. The lighting arrangements are perfect in every respect. Owing to the light courts and the enormous glass area the building is certainly amongst the best lighted in the city. Most of the windows of the upper floors are double hung, the others being casement windows. On the second, third and fourth floors, the windows are unusually large-sized with pivotted sides. The building is electrically lighted throughout, direct lighting being used, and in the way of toilet and other accommodation on each floor the arrangements are modern in every particular. In a structure of the importance of the Ryrie building provision against fire is a necessary detail. Ample protection in this respect is ensured by the installation of the "Sprinkler" system, which is fed direct from the mains. All the "Sprinkler" piping is concealed, and though this was one of the extremely difficult conditions which the architects had to meet yet it was successfully carried out. By this arrangement nothing will detract from the appearance of the building, inasmuch as there will be no unsightly pipes exposed to the view. The construction is steel frame with wood joists, all the supporting steel columns being fireproofed, and this taken in conjunction with the fact that the building is fitted with the "Sprinkler" the risk of fire is therefore reduced to a minimum. The

basement in the new section of the building is a feature in itself. It consists of a room the full size of the large corner store, with terrazzi floor, and being well lighted, would be suitable for a restaurant. The heating arrangements are no less up-to-date than the other features of the building, the system utilized being steam supplied by two low-pressure return tubular boilers located in a fireproof boiler room, under an exterior court. In addition there is a domestic hot water plant which supplies water to all toilets throughout the building. Apart from the main staircase running from the basement to the fifth floor there is also an auxiliary fire stair situated in the old section of the structure. Two sets of fire escapes have also been provided on the public lane at the rear.

The building is divided by a brick wall running from the bottom to the top, hall openings being protected by "Underwriter" fire doors concealed in "pockets." The cornice running around the building is of copper with a sufficient projection to throw a strong shadow line around the structure. In the spandials between the large semi-circular head win-



The new Ryrie Building, Toronto. Architects: Messrs. Burke, Horwood & White.

dows are polychrome terra cotta medallions which add to the artistic features.

The materials used in construction are Milton pressed brick with Portage Entry stone trim on the two lower floors, and terra cotta trim on the upper floors. The brick used in the building is the fumed flash brick which the Milton Pressed Brick Company have been making only during the past year. It is an exceptionally hard burned brick running from a light tan to a dark brown color. The entrance vestibule, hall, staircase and elevator halls are finished in statuary veined Italian marble, with Botticino trimming. The stairway from ground floor to basement, and from ground floor to second floor, is of marble with ornamental iron railing.

The architects who carried out the work with characteristic efficiency are the firm of Messrs. Burke, Horwood & White, Toronto. The contractors were: Messrs. Elgie & Page, masonry; Black Building Sup-

ply Company, Toronto, Agents for the North-Western Terra Cotta Company, Chicago, supplied the terra cotta trim; J. C. Scott Company, Limited, carpentry; Mr. R. C. Dancy, plastering; A. Matthews Limited, sheet metal and roofing; Messrs. Fred G. Roberts & Company, painting and glazing; Canadian Allis-Chalmers Company, architectural iron and bronze; Toronto Structural Steel Company, Limited, structural steel; Bennett & Wright Company, Limited, heating, ventilating, plumbing and wiring; this firm also installed the "Sprinkler" system; and Norcross Brothers carried out the marble work.

Proposed New Hotel for Windsor, Ont.

By the courtesy of the architect, Mr. J. W. Wilson, we are enabled to present herewith a perspective view of the proposed Windsor Hotel which is to be erected at Windsor, Ont., at a cost of some \$350,000. The building will be of reinforced concrete throughout. The exterior will be of cut stone, terra cotta and glazed brick. On the ground floor there will be a large rotunda, public and private dining rooms, writing room and all the other accommodation provided in an up-to-date city hotel. The basement will contain barber shops, sample rooms, billiard room, kitchens, heating and ventilating plant. There will be approximately 150 bedrooms—all equipped with separate baths and wardrobes. The upper floor will be arranged to accommodate conventions, balls and other functions. It is hoped to start opera-



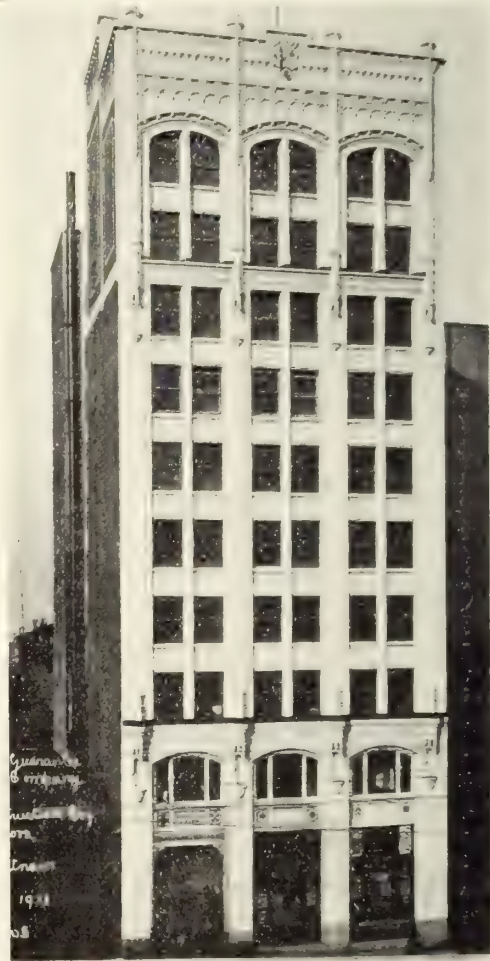
Proposed Windsor Hotel, Windsor, Ont. Architect: Mr. J. W. Wilson, Detroit. Estimated cost, \$350,000.

tions before the end of March and to complete the erection of the hotel and open it for business in about six months.

The architect, Mr. Wilson, whose offices are at Detroit, Mich., and Chatham, Ont., is a Canadian by birth and is a member of the Ontario Association of Architects.

Another Ten - Storey Office Building for Vancouver

THE Yorkshire Building, Vancouver's newest office block, is located on a site on Seymour street, between Pender and Dunsmuir, chosen with a view to providing the various offices with plenty of light, there being an unobstructed space on all sides. This structure is ten storeys in height and has a frontage of 50 feet and a depth of 120 feet. The construction is reinforced concrete, with pressed brick for the side walls and white glazed terra cotta for the front elevation, the design being carried out very successfully in an imposing Gothic style. The foundations on the street frontage are of granite, extending to a height of about three feet above



Front elevation, Yorkshire Building, Vancouver. Architects: Messrs. Somervell & Putnam, Vancouver. Estimated cost, \$300,000.

the level of the sidewalk. The main entrance lobby, twenty feet in height, is decorated from floor to ceiling in terra cotta, the detail around the top being heightened with gold leaf treatment which provides a most attractive contrast. The flooring of this space is in marble, as is also the flooring of the elevator hall, the walls of which are finished in Rubio "G" marble. All corridors are wainscotted to a height of three feet with glazed tile and floored in terrazzo. The corridors are well lighted, this being due to the fact that above the wainscoting the walls are composed almost entirely of glass. The ground floor has been fitted up for carrying on a general banking and trust business, and will be occupied by the Yorkshire Guarantee and Securities Corporation, Limited, and the Yorkshire

Insurance Company, Limited, the joint owners of the building. The floors of the banking rooms are finished in terrazzo with marble baseboards, and the counters and office partitions are to be of selected oak, this wood being used as interior finish throughout the building. A commodious private office for the assistant manager and the staff has been provided on this floor in addition to a reinforced concrete vault. The manager's office, situated on the mezzanine floor, is panelled from floor to ceiling in oak, and immediately adjoining there is a large room finished in the same style for the use of the directors. A feature in the

construction is that the building has been left without partitions on seven of the upper floors, excepting in the corridors, this arrangement enabling tenants to suit their own requirements. The floors of all offices are covered with cork linoleum. The typical floor contains eleven single offices, and a suit at the rear comprising five offices. The toilets throughout the building are excellently lighted and ventilated, and are fitted with white porcelain basins. The walls are of white ceramic tiles. The Webster vacuum system of heating has been installed. All electrical work is laid in fireproof conduits.

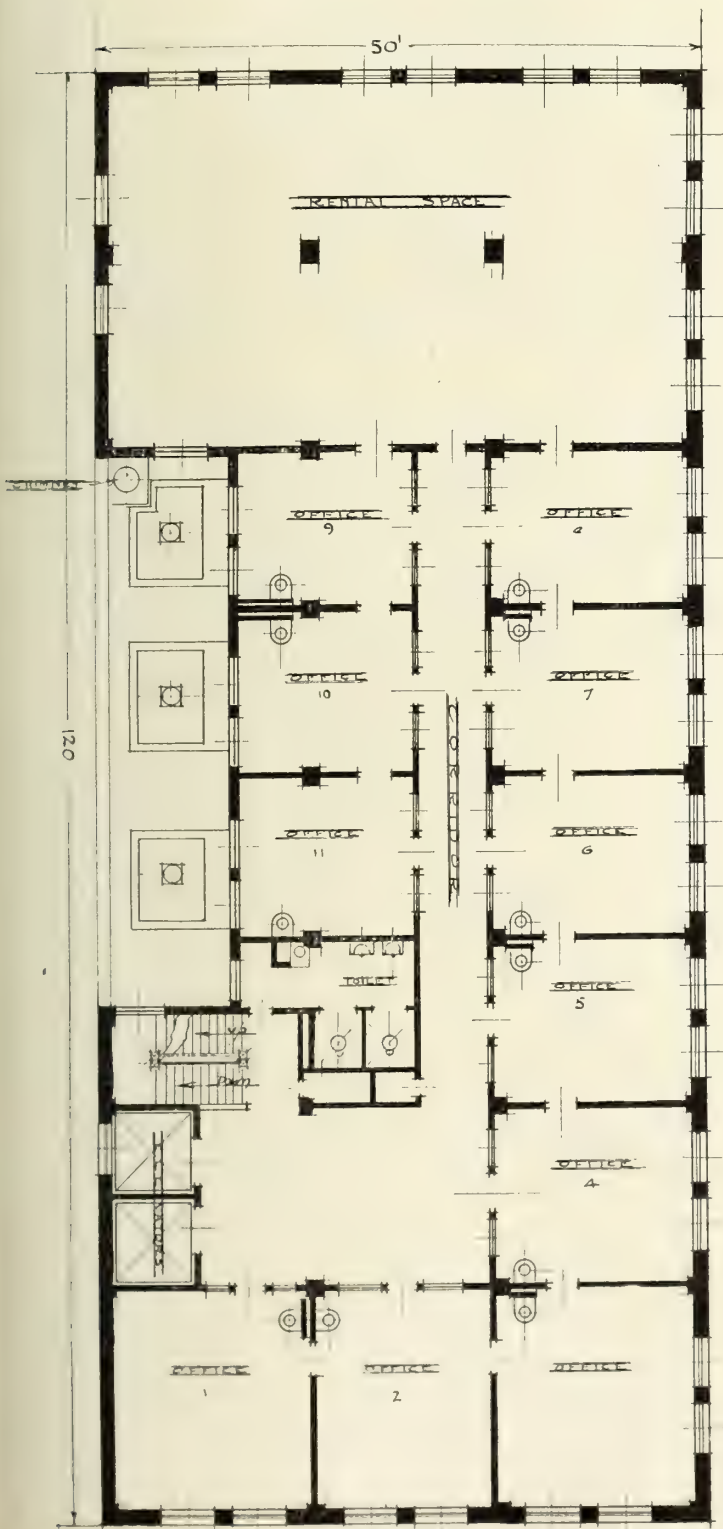
Messrs. Somervell & Putnam, Vancouver, designed the building, and the work of construction is being carried out by the Dominion Construction Company, also a local firm. The cost complete is estimated at approximately \$300,000.

The reason why oil paint will not stand well on concrete surfaces is that the oil is saponified by the free lime of the cement. It is stated in a French architectural journal that this drawback can be obviated by first applying a wash of zinc sulphate in the form of a 1:5 solution, the result being to produce a film of plaster and zinc oxide which is quite harmless to oil.

Seattle harbor improvements to the amount of \$21,300,000 have been executed or authorized. The improvements include dredging and the construction of a canal, lock, warehouses and cold-storage plants. These and other facts are given in a paper by Charles Evan Fowler in the "Extension Journal" of the University of Washington. The paper summarizes important data of most of the large seaports of the world and reviews the principal types of docks, piers and equipment. It estimates the cost of port development in a number of important cities—\$186,700,000 for London, \$125,000,000 for Liverpool, \$100,000,000 for Hamburg, \$83,500,000 for New York and \$90,000,000 for Manchester.

The question is sometimes asked whether concrete reservoirs are suitable for the storage of oil. We may, therefore, usefully refer to the experience of the Atchison, Topeka and Santa Fe Railway Company, as briefly summarised: On the Albuquerque Division concrete lined reservoirs have not been affected by oil; on the San Joaquin Valley Division several concrete linings have been used for oil reservoirs and sumps, and no special effect of the oil has been observed; on the Arizona Division concrete lined oil sumps are used, and although the oil is at a comparatively high temperature the concrete in the sumps has not shown any sign of deterioration.

New uses for concrete never cease. The latest is a concrete automobile sightseeing tower, which it is proposed to construct in Denver. It is to be 200 ft. high and 200 ft. square at the base and to have encircling it an automobile road up which cars may run with ease, for the maximum grade will be 3 per cent. The distance by the road from bottom to top will be 1,500 ft., and on top will be a 100-ft. square platform on which the machines can be parked without difficulty. The estimated cost is \$100,000. The tower is elaborate in conception and promises to afford a means whereby automobile tourists may see the mountains from the city of Denver without leaving their cars.



Typical floor plan, Yorkshire Building.

New Power and Waterworks Plant, Merritt, B.C.

By N. M. Hall, Supervising Engineer

SOON after the incorporation of the city of Merritt, B.C., steps were taken by the new council to add to the rapidly growing city a much needed waterworks system, and at the same time an up-to-date electric plant to replace the small privately-owned system formerly in service. Messrs. DuCane Dutcher & Company, consulting engineers, of Vancouver and Calgary, were commissioned by the city to look into the situation, and in June, 1912, were able to present a report favorable to the installation of a steam generating and pumping plant, and the necessary electric power and waterworks distributing systems. Generation by steam was recommended on account of the proximity to the extensive coal mines of the city from which fuel was obtainable at a reasonable cost. A gravity water system was not favored due to the excessive cost of pipe lines, but was reported on as a possible future undertaking. The source of water is the Coldwater river, a mountain stream of considerable size, and the pumps were to pump directly into the city system with an overflow tank on an adjacent hill to provide a head of about 25 feet. In July, 1912, the report was accepted, and the necessary money by-laws passed by the city.

The site chosen is on the east bank of the Coldwater River, about 300 feet from the stream. The choice was made in order that the water would be thoroughly filtered in percolating through the gravel bank to the pump well, which is located partly under the power house building. This well is approximately 6 x 10 x 13 ft. deep, and connects by two 8-in. pipes with another well 6 x 20 x 8 ft. deep, located towards the river. Both wells are sheet piled to prevent gravel falling in, and the outer one is arranged with close screens to permit of easy cleaning.

The building, which is of reinforced concrete with wooden trusses supporting a corrugated iron roof, was erected by Fowler & Larsen, local contractors. An intermediate wall divides the boiler room from the engine and pump-room. In each end is a centrally located double sliding door, and in the boiler room on opposite sides are smaller doors, one near the stack for the removal of ashes, and the other for wheeling in coal from the adjacent coal tracks. A concrete floor in the engine room covers all except the entrance to the wiring and rheostat pit behind the switchboard.

The boilers, stack and feed pumps were supplied by the Canada Foundry Company of Vancouver. The boilers are return tubular 72 x 18 ft. in one battery connected by a circular steel breeching to the 48 x 65-ft. steel stack just outside the building. The duplex feed pumps are for use in emergencies only, as the city water pressure will feed the boilers under ordinary conditions. The Griscom Spencer closed feed water heater was supplied by the Chas. C. Moore Company, of Seattle. This type was chosen in preference to the open type on account of the little attention required due to the excellent quality of feed water.

The generator unit consists of cross compound vertical high speed Goldie-McCulloch non-condensing engine direct connected to a Canadian General Electric Company 125 k.v.a., 2200 volt, 3-phase, 60 cycle, with direct connected exciter. The unit runs at 450 r.p.m., has forced lubrication and sensitive governor, and complete set of gauges and tachometer.

The switchboard and all wiring and conduit installation was supplied by the Canadian General Electric Company. The board, which is of blue Vermont marble, consists of one combined generator and exciter panel and three feeder panels, as shown in the accompanying photographs. All

wiring is in conduit and all lines lie under the floor, and extend up the wall to the outlet in lead cable in conduit.

The rheostat pit is under the switchboard and suspended from the ceiling are the instrument transformers. The pit is concrete lined and damp-proof. The pumps, which are each of 400 gallon per minute capacity, are located as shown in the accompanying plan, and directly over the suction well. Both were supplied and installed by the Canada Foundry Company. The single stage pump is driven by a Terry non-condensing steam turbine at 2100 r.p.m. and is intended for a standby in case of fire or emergency. The other is two-stage, 1750 r.p.m. Mather & Platt type and is driven by a Canadian General Electric Company 55 h.p., 2200 volt wound motor. The secondary grids are located in the rheostat pit, and the controller is shown near and to the rear of the board.

The constant current transformer for the series street lighting circuit was supplied by the Canadian General Electric Company. Included is the control panel with plug switches, and lightning arresters. The capacity is 10 kw. and controls a 40-lamp, 7.5 ampere circuit. At present only one 3-phase circuit leaves the station, and the spare panels are used to control the motor-driven pump and the series circuit respectively. These connections are temporary only as these panels can at any time be used for additional circuits.

The present overhead distribution consists of a 2200 volt, 3-phase circuit with 110 volt secondaries and a single phase 2200 volt series circuit operating street lamps. The latter circuit is of No. 8 W.P. wire, while No. 6 and No. 8 W.P. is used on the three-phase and secondaries and arranged to give the best voltages. The transformers, including that for the station lighting, are the standard C.G.E. Co. pole type and protected by primary fuse plugs. The street lamps were supplied by the Canadian General Electric Company and are hung from No. 10 Messenger wire spanning the street and isolated by two suitable strain insulators. The series lamps are 200 watt and 7.5 ampere.

The Waterworks System

The waterworks system consists of an 8-inch main leading from the pumps to the city system, and thence to the 50,000 gallon reservoir on the hill opposite. The city system consists of a network of 6 and 4-in. pipe, fully equipped with isolating valves and hydrants. All pipe used was steel, hub and spigot, and supplied by Robertson Godson & Company, of Vancouver. The seventeen hydrants were all of the modern Ludlow type.

The wood stave tank was supplied by the Municipal Construction Company, Vancouver. A tell-tale visible from the power house indicates the water level. The overhead wiring was installed by A. B. Kennedy, local electrical contractor, and the machinery, switchboard and connections by the Canadian General Electric Company. The boiler installation and piping, as well as the waterworks system, were put in by day labor.

About March 10th, 1913, the power was turned on the city, and about the same date the waterworks system was put into commission. A pressure was obtainable at each hydrant of 100 lbs. per square inch, which gives ample fire protection. The water filtering through the natural gravel bed is of good quality and quite free from sediment and scale-forming impurities. The plant, since being put into commission, has run practically without interruption and the city has a plant with ample capacity and reliability to meet the demands of the city and district for at least five years to come. The design and supervision of the work were in charge of DuCane, Dutcher & Company, consulting engineers, Vancouver and Calgary.

Toronto the Mecca of Good Roads Enthusiasts Last Week

The Twelfth Annual Convention of the Good Roads Association of Ontario

The Twelfth annual meeting of the Good Roads Association of Ontario opened at York County Council Chambers, Toronto, on February 24 and concluded on February 26. The president, Mr. M. Vermilyea, of Belleville, presided, and there was a large attendance of delegates from various parts of Ontario. The morning session was taken up with the report of the Executive Committee, followed by the presidential address, appointment of committees, and address by Mr. L. S. Squire, of Waterford. At the afternoon sessions Mr. Canby Wismer, of St. Catharines, read an interesting paper on "Trunk Roads," and "County Roads" was the subject of a paper read by Mr. John A. Vance, of Waterdown, Wentworth County. Mr. H. D. Cleminson, of Prince Edward County, urged better inspection of roads, especially when they were being built, but believed in a system of trunk roads, and in the government providing a short course for road superintendents and foremen in order to instruct them in drainage and other necessary training in road building. Mr. W. D. Flatt, of Hamilton, spoke in favor of the building of concrete highways.

Mr. E. A. James, County Engineer of York, who addressed the convention on the subject of "County Roads," said he was in favor of sub-division of road systems into township and county and trunk systems. He did not think roads should be classified, but that everybody should try and make every road the best for the general travelling public. The trouble in his opinion was the financing of the problem.

Wednesday's session was opened with a paper on "Township Roads," read by Mr. Chas. Bush, of St. Catharines. He said that townships were slowly but surely being brought into line with the good roads movement, and in many places were considering the necessity of building for the future. He thought that in all organized townships statute labor should be abolished and replaced by a business-like system under central control. Every county should have a good roads system association, and every board of trade a good roads committee. The cities, he thought, should contribute a fair share towards the upkeep of the county and all main roads connected with the principal thoroughfares. An important item of handwork, which was so often neglected, was the keeping of old ditches and culvert outlets open. The frequent source of trouble in macadam roads was that of allowing the earth sides to be higher than the edge of the stone, thus preventing water from running off easily. The earth sides of the stone road needed constant attention, and should be smoothed down with a drag. An interesting discussion followed in which Mr. J. W. MacLeod, of Cornwall, Mr. Chas. Ketcheson, of Belleville, and Mr. J. H. Garbutt, of Peterborough, took part.

A paper on "Roads of Queen Victoria Park," was read by Mr. J. H. Jackson, of Niagara Falls, and Mr. A. F. Macallum, C.E., Hamilton, followed with a paper on "City and Town Streets." The ideal road was one that was clean, sanitary, noiseless, and not slippery, and in his opinion would soon come. It was impossible to maintain good roads in cities with the present poor system of laying car tracks.

Prof. Laing, of the University of Toronto, spoke on the need of training men employed in road construction. Courses were now being given in the university and everybody should take advantage of them, and make themselves still more fit for the positions they were occupying at the present time.

Mr. C. A. McGrath, of Ottawa, Chairman of the Ontario

Highway Commission, in an able address, said it was not particularly the trunk roads that the commission was looking after, but all roads in the province that would meet the demands of the people.

Mr. W. A. MacLean, Chief Engineer of the Commission, spoke in favor of abolishing statute labor on roads, stating that in his experience it was detrimental to the building of good roads.

Suggested Amendment to Highways Act

The following resolutions were unanimously passed:—

"That the Municipal Act and the Highway Improvements Act should be amended so that moneys raised by debentures for highway improvement purposes, and the amount received from the Provincial Treasurer on account of expenditures under the Highway Improvements Act, shall form a special fund to provide for expenditures under the Act.

"That the convention places itself on record as being in favour of the abolition or commutation of statute labor in organized townships.

"That the Government be asked to extend the provisions of the Highways Improvements Act to organized townships that have abolished or commuted statute labor, and established a good organization for construction and maintenance.

"That we approve of the recommendation of the executive for an increase in cost of motor vehicle licenses and taxation of railways to form a fund for highway improvement purposes."

At the afternoon session an address was given by Hon. Dr. Reaume, Minister of Public Works, Ont. This was followed by an informative paper read by Mr. L. E. Allen, of Belleville, Engineer of Hastings County. He traced the history of bridges from the time of the first cast-iron structure in 1850 down to the erection of the steel bridge about 1875, pointing out that the first concrete arch was made in France in 1869. Discussing bridge building in Hastings County, Mr. Allen said it was customary in that county to put a few inches gravel on top of concrete bridges so as to get rid of the smooth surface of the concrete. He advised the township councils to make a thorough and accurate survey of all bridges, and bridge work in the township, and that all possible data be secured before construction was begun.

An interesting discussion followed, in which Mr. Frank Barber, C.E., Bridge Engineer, York County, and Mr. C. R. Wheelock, Orangeville, Engineer of Peel County, took part.

The convention concluded early on Thursday when papers were read on "Dragging Earth Roads," by Mr. A. Denholm, of Blenheim; "Value of Roads to Cities and Towns," by Col. W. N. Ponton, Belleville; and "Haulage of Farm Produce," by Mr. Robert Thompson, St. Catharines.

Election of Officers

The election of officers for the ensuing year resulted as follows:—Hon. Presidents, Messrs. T. L. Kennedy and N. Vermilyea; President, Mr. J. A. Sanderson; First Vice-President, Mr. S. G. Squires; Second Vice-President, Mr. K. W. MacKay; Secretary-Treasurer, Mr. George S. Henry, M.P.P. Executive Committee, Messrs. F. A. Senecal, T. E. Allen, R. H. Lush, J. J. Parsons, W. H. Pugsley, and C. R. Wheelock.

Excavating is completed and work will begin shortly on stores and offices to cost \$100,000, at Swift Current, Sask. Mr. M. Healey, Toronto, is the architect.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

Mr. C. Chapois, district engineer, with headquarters at Quebec, has sent in his resignation to the Department at Ottawa.

Mr. Joseph Giroux, Quebec, has secured the contract for a \$175,000 church at Jonquiere, Que. The architect is Mr. J. P. Lemay, Quebec.

The Dominion Government is appointing a commission of three to consider the commercial feasibility of the Georgian Bay Canal project.

A company with \$100,000 capital, including Boston as well as local investors, has been organized to erect a hotel at St. John, N.B., at a point seventeen miles up the river.

Contract and sub-contracts are being awarded for an addition to the University of Ottawa estimated to cost \$150,000. Mr. C. P. Meredith, of the federal capital, is the architect.

Plans are in course of preparation for a new church at the corner of Grace and Mansfield streets, Toronto, to involve an outlay of \$100,000. Mr. A. W. Holmes, Toronto, is the architect.

Mr. H. Dunlap Morrison, of Montreal, is the architect for the new office building being erected in that city at an estimated cost of \$200,000, upon which tenders will be invited within a month.

A joint committee of Montreal aldermen and controllers will study the report of the engineering department recommending the construction of three subways for electric cars at an estimated cost of \$20,000,000.

The Montreal Council have voted an appropriation of \$1,000,000 for the construction of sewers. The largest amount was for \$510,000 for the construction of a trunk sewer in Emard Ward, St. Paul and St. Gabriel Wards.

The city of Peterborough, Ont., has had plans prepared for a sewage disposal system estimated to cost \$100,000. If the plans are approved by the Provincial Board of Health, tenders will be called by the City Engineer, Mr. R. H. Parsons.

The Dominion Government has granted \$40,000 towards the cost of a lift bridge to cross the Rideau River at Pretoria Avenue, Ottawa. Plans are being prepared by Mr. A. Currie, City Engineer. The structure will cost about \$120,000.

The town of St. Lambert, P.Q., have sold bonds to the value of \$480,000, which sum will be expended in the extension of concrete sidewalks, asphalt, bituminous macadam and concrete pavements, water mains and storm sewers, street widening and standard-lamp street lighting.

Leave to appeal against the judgment of Mr. Justice Lennox, quashing the Ottawa Water Works by-law, has been granted by the Appellate division at Osgoode Hall. The trial judge ruled that the by-law was bad as the city proposed to spend \$8,000,000 on the new system, which was \$3,000,000 in excess of the amount authorized to be spent by the legislature without a vote of the ratepayers.

Subject to the approval of the ratepayers, the city council of Westmount, P.Q., will borrow \$1,210,000 for public

improvements. This sum will be spent—\$350,000 on new municipal buildings, \$160,000 for expropriating a street, \$250,000 for improving the street lighting and placing the wires in underground conduits, \$200,000 for paving private lanes, and \$250,000 for street extension and paving.

Messrs. Jamieson, Lea, and Heckle, the experts employed by the Montreal Controllers, have made their report on the break in the water conduit. It is a long document, and deals in detail with the causes which led to the break. The work of repairing the conduit continues; the concrete work has been strengthened in every direction, and although there are leaks, means have been taken to ensure that they will not lead to any damage.

The Montreal Harbour Commissioners have asked the Government to provide \$15,000,000 to be spent during the next five years. The expenditure this year is estimated at \$3,000,000, the programme including additional pier and shed facilities. Two new steel and concrete piers for ocean liners will be constructed, while the wharves will also be extended. A large sum will be needed to complete the work in connection with the Vickers drydock at Maisonneuve, P.Q.

A deputation from Montreal have visited Ottawa and asked the Government, through Mr. Borden, to guarantee fifteen million dollars, interest on bonds to be issued for constructing a tunnel connecting Montreal with the south shore of the St. Lawrence. The tunnel, it was asserted, would give much-needed independent access to the city for railway purposes, and will provide a broad avenue to the south for traffic which must accrue to Montreal from the building of the Transcontinental.

Messrs. Marsh, Hutton & Powers, who have obtained the contract for the construction of a new Government Customs building at Port Arthur, have commenced the construction of the building, which will have a frontage on Arthur street of 160 ft., and of 70 ft. on Water street. The basement storey is to be of stone, while the remainder of the building will be of pressed brick with stone trimmings. The building will be fire-proof throughout, being constructed of structural steel, of which over 400 tons will be used, and reinforced concrete. The building will cost approximately \$250,000.

In his annual report to the twenty-second annual meeting of the Association of Ontario Land Surveyors, which was held in Toronto recently, the president, Mr. J. S. Dobie, of Thessalon, said that with the opening up and colonization of Northern Canada, the construction of a new system of roadways throughout the different provinces, and the extensive railroad construction going on, the prospects were bright for surveyors. Mr. H. O. Dempster read a paper on "Surveys in British Columbia," and Mr. H. T. Routly, of Haileybury, contributed a paper on "Contour Survey of the Abitibi River."

Constructional work in Fort Frances, Ont., showed marked development during 1913. A total of \$3,044,250 was expended on improvements during the year. The more important of these works included the construction of the Ontario and Minnesota Power Company's building at a cost of one and a half millions; the Shevlin-Clark Company's No. 2 mill, \$350,000; the Johnson-Carey Company (rock fill), Rainy Lake, at a cost of \$380,000; the Canadian Northern Railway Com-

pany, passenger station and improvements, \$50,000, and the new building for the Canadian Bank of Commerce at a similar amount.

Mr. A. Currie, city engineer of Ottawa, has issued a report on Mayor McVeity's pure-water scheme for the city. The Mayor's suggestion is to take the water from the Ottawa River at a point not higher up than Britannia Bay on Lake Deschenes, by an all-land pipe from the Ontario shore to the present pumping station, with a low service reservoir and rapid sand filtration. Mr. Currie's report, which endorses the idea, recommends a point beyond Ramoux and Little Chaudiere Rapids as the location for the intake, thus securing the water supply some distance above the point where the river becomes seriously polluted. The cost of construction is estimated at \$1,700,000 and the cost of operation \$89,000.

The St. John city council has received a report from Clarence Goldsmith, an American expert, who recently made an investigation of the city's water supply. As a result of his recommendations the city will lay sufficient additional water pipe to gridiron the most important section of the city, and will also take action as will very considerably increase the pressure at the point where the great mains enter the city. A better system of fire hydrants will also be provided, and other changes made which will greatly improve the general distribution service, and its efficiency in the event of fire. The city is fortunate in the possession of a gravitation water supply of the water from Loch Lomond, ten miles distant, while the western side of the city is supplied from Spruce Lake. Mr. Goldsmith made a very careful investigation of the whole system and his report will be made the basis of future work of improvement.

WESTERN CANADA

Winnipeg building permits for January and February total over \$1,000,000.

The Manitoba Government has voted \$2,500,000 to be used under the Good Roads Act.

Paving work estimated to cost \$750,000 is one of the items on Edmonton's constructional programme for 1914.

A good building season is predicted for Edmonton during this year according to a recent statement made by Mr. N. A. McIvor, building inspector.

Tenders have been called for extensions of the water pipe line to new wells at Winnipeg, at a cost of \$234,150. The work is in charge of Mr. J. N. Ruttan, Winnipeg.

The Burrard Peninsula joint sewers commission is to spend approximately \$2,000,000 in Greater Vancouver this year, according to a statement made by Frank Bowser, chairman.

A site is reported to have been secured for a \$1,000,000 college to be erected at Regina, Sask., by the Saskatchewan Presbytery. Grants for the building have already been obtained.

An elevator of reinforced concrete and brick construction, estimated to cost \$300,000, is to be erected at Regina, Sask., on a site donated by the city to Messrs. Leitch Bros., of Oak Lake, Man.

The Pantages interests of Seattle, Wash., contemplate the erection of a new theatre estimated to cost \$250,000, at Vancouver, B.C. Mr. B. M. Pretica, of Seattle, is named as the probable architect.

The British Columbia Construction & Engineering Company, of Victoria, the general contractors for the new departmental store of the Hudson's Bay Company at Victoria, are planning to start work at once. The building will be of

steel and concrete construction and will cost something like \$1,250,000.

Plans prepared by Professor Stoughton, head of the Department of Architecture at the University of Manitoba, have been approved by the University Council for the grouping of the new University buildings at St. Vital.

At an estimated cost of \$1,000,000 a twelve-storey hotel of steel and tile construction is being erected on Smith street, Winnipeg. The architects, Messrs. James Chisholm & Sons, are receiving private tenders for the work of completion.

A new three-storey apartment block, to be of stone foundation, brick construction and felt and gravel roofing, and costing \$200,000, will be erected in the spring in Winnipeg. The architects, Messrs. Jordon & Over, will receive tenders until April 15.

The first floating wharf to be constructed by the Dominion Government on the west arm has been completed at Hallett's Landing, opposite Harrop, Western Canada. The first wharf of this type to be completed in Kootenay Lake waters was at Argenta.

The Saskatchewan Government, through the highway commission, has decided to repeat the innovation of last year by holding a competition during 1914 for the maintenance of roads by using the road drag. All organized municipalities will be invited to enter the contest. As there is much interest in the question of good roads the competition this year should be keen.

The claims of Vancouver for the grain elevator to be established by the Dominion Government on Burrard Peninsula are being strongly urged by the board of trade of that city. It is understood that a site on Burrard Inlet, near the location for the new government dock now under construction between Salsbury and Commercial drives, will be recommended to the grain commission.

Mr. T. H. Navin, of Moose Jaw, was elected President of Saskatchewan Builders' Exchange at the recent convention. It was decided that the interests of the builders, as far as affected by the proposed legislation, will be looked after by a committee of Regina contractors. The Architects' Association of Saskatchewan will be asked to take steps to have the amended Winnipeg Builders' Exchange form of uniform contract used exclusively on all work in future.

There is every possibility that the construction of a ten-storey office building for Weiler Bros., Limited, of Victoria, the well-known firm of house furnishers, will be undertaken during the coming spring. So far as can be learned, the structure will be a massive affair of steel, concrete and brick construction, costing about \$250,000, and will occupy a site comprising 120 x 120 feet at the corner of Douglas and Kane streets. Mr. A. A. Cox, Vancouver and Victoria, is the architect.

At a meeting of the Canadian Mining Institute in Vancouver recently, Mr. E. E. Campbell, chief engineer of the Granby Consolidated Company, announced in connection with the copper mining operations of the firm that a complete reduction plant with three blast furnaces, having a capacity of about two thousand tons a day, was in course of erection. He also stated that the company had acquired other properties and intended soon to start development in Alaska where a plant will be put down almost immediately.

Nine million dollars is the estimated expenditure for civic improvements in Edmonton during 1914. This includes \$2,164,196 for sewers and \$1,125,330 for waterworks and a filtering plant. These extensions have been authorized by the city council, and it is expected that work will begin early the

coming spring. Architects and contractors estimate that buildings costing fully \$10,000,000 will be erected this year. One of the important structures is the McLeod building, costing \$900,000. Another projected building is a ten-storey hotel, costing \$500,000, and a church building to cost \$100,000 for St. Joachim's congregation.

A deputation representing the civil engineers of British Columbia waited on the executive council recently with a protest against a clause in the Municipal Act, which they hold gives the municipalities of the province practically the right of interpretation of the term "civil engineer." It was suggested that the definition of the term should be "one who is a member of the Canadian Society of Civil Engineers, or the sister organization of Great Britain, or some society for which the qualifications of admission to membership were recognized by these two parent societies." The Premier promised that the matter would receive the consideration of the Executive Council.

Messrs. Davis & Leslie, consulting engineers, Vancouver, have been entrusted with the laying out of the North Fraser harbor, B.C. Col. Davis, who is a member of the Canadian Society of Civil Engineers, was the first graduate to pass the Royal Military College, Kingston. He was well-known in Eastern Canada as a successful engineer, having carried out many important works. Major Leslie, who is a member of the Institute of Civil Engineers as well as of the Canadian Society, has had world-wide experience in railway and harbor works. The firm are the representatives for British Columbia of the well-known English harbor engineers, Sir Douglas Fox and partners.

Canadian Railroad Development

Announcement is made that construction work on the Alberta and Great Waterways Railway, from Winnipeg to Fort McMurray, will begin within ninety days.

Messrs. Hyland & Galloway, contractors for the work of extending the Grand Trunk Pacific line from the town of Harte to Brandon, Man., have their outfit ready to commence the grade at the opening of spring.

The Newfoundland Railway and Train Ferry Syndicate, Limited, have been given authority to construct, equip and operate a line of railway from the south-west arm of Green Bay to the Humber Mouth, Bay of Islands.

A survey for an extension of the Temiskaming and Northern Ontario Railway having been finally made, construction is expected shortly to commence. The survey extends from Elk Lake to Gowganda, and will connect by a continuous line of railway Sudbury, Gowganda and Cochrane.

A bill has been introduced in the Dominion Parliament advocating the building of a line of railway from Woodstock and Hamilton, through Brantford; from Hamilton to Niagara Falls via St. Catharines, with branch lines from Hamilton to Toronto, and from Woodstock to some point on Lake Huron. The bill seeks to extend the charter to the South Ontario Pacific Railway Company. This charter is 27 years old, and only 16 miles of road are built.

The Transcontinental Railway Company of Canada is having a Canadian car-ferry and ice-breaking steamer built by the Campbell Laird Company, of Birkenhead, Eng. The vessel is intended for service on the St. Lawrence, between Quebec and Levis. Its principal dimensions are: length, 326 ft.; beam, 65 ft.; with a draft of 15 ft. Trains are carried on a tidal deck arranged above the main deck of the steamer on three lengths of track, each of which is about 272 ft. long.

The Canadian Pacific Railway is projecting a five-mile double-track tunnel through Mount Macdonald, B.C. The enterprise is officially known as the Rogers Pass tunnelling

scheme, and the related improvements will involve an expenditure of more than \$10,000,000. The tunnel will rank as the longest railway bore on the American continent. The work is expected to be completed by December 31, 1916. It will mean the elimination of "loops," miles of snowsheds, will reduce the distance by four miles, and effect a big grade reduction as well.

The Canadian Pacific Railroad extension plans involve a total expenditure of approximately \$35,000,000. There are 133 miles of double-track under way between Sudbury and Port Arthur, to cost \$6,000,000; 178 miles double-track between Brandon and Calgary, to cost \$5,000,000; and 139 miles between Revelstoke and Vancouver, to cost \$7,000,000, in addition to other works. Before the company is through with its present programme of construction, including the irrigation works, the double-tracking, and the new trackage (amounting to about 1,200 miles), it will have expended about \$450,000,000 in the western part of the country since its inception.

Personal Mention

Mr. C. H. Topp is the new engineer for Esquimaux, B.C., in succession to Mr. W. E. Casey, resigned.

Mr. E. R. Bingham has been appointed corporation surveyor for Port Arthur in succession to Mr. A. L. Russel, who recently resigned.

Mr. Joseph Copeland, who had been inspector of sidewalks for North Toronto for some years past, died on February 18 after a short illness.

Mr. J. Antonisen, C.E., has resigned his position as superintendent of the Brandon Street Railway Company. He was formerly city engineer of Port Arthur and later of Moose Jaw.

Mr. H. F. Christie, assistant city engineer on bridges, read a paper on "The Low Level Bridges Across the Saskatchewan at Edmonton," before a meeting of the Edmonton Engineering Society recently.

Mr. J. W. Kirkpatrick, of Peterborough, has been elected president of the Association of Ontario Land Surveyors. Mr. E. T. Wilkie, of Toronto, vice-president, and Mr. L. W. Rorke, also of Toronto, secretary-treasurer (re-elected).

Mr. George P. Hemstreet, Superintendent, the Hastings Pavement Company, Hastings-on-Hudson, N.Y., recently delivered an illustrated lecture on "The Manufacture of Asphalt Blocks" before the Graduate Students in Highway Engineering at Columbia University.

Mr. J. E. Jones, Civic Stone Inspector, of Toronto, died on February 23 from an attack of apoplexy. The death of Mr. Jones is the third in the City Architects' Department since the opening of the investigation recently, Mr. James E. Riddell, Chief Building Inspector, having passed away on February 20.

Mr. Henry W. Thornton, General Superintendent of the Long Island R. R., Jamaica, has been appointed General Manager of the Great Eastern, the largest railway system in Great Britain. The company possesses 1,217 miles of track over 1,000 locomotives, 5,400 passenger cars, 27,000 freight cars, and 17 steam boats.

Professor A. H. Blanchard, of Columbia University, New York, recently delivered illustrated lectures at the University of West Virginia on the subjects, "Park Boulevards," "Bituminous Surfaces and Bituminous Pavements," "Wood Block and Stone Block Pavements," and "Modern Developments in Highway Engineering in Europe."



Before



After

"Before and After" the application of Bay State Brick and Cement Coating.

Artistic Treatment of Cement Surfaces

The accompanying views illustrate very clearly the outward and visible possibilities of Bay State Brick and Cement Coating, manufactured by Messrs. Wadsworth, Howland & Company, Inc., 64 Washington street, Boston, Mass. This firm has solved the problem of producing a compound which when applied to cement gives a durable, pleasing exterior finish without showing a painted effect, and which at the same time is unaffected by dampness or alkali action. By practical demonstration the company found that the base of their compound must be of a concrete nature. The only medium suitable to such a base is one which does not contain an oil, which is affected by alkali, and one which will evaporate immediately and entirely upon application, leaving the base of the coating an integral part of the surface, and not as a skin coating like ordinary paint. Bay State coating is made in many pleasing tints and has a wide range of application.

Trade Notes and Miscellany

The seventh Chicago Cement Show which was held from February 12 to February 21 was very successful in every respect. The exhibits of cement and concrete materials were particularly good, and attracted engineers and contractors in considerable numbers.

The recently-incorporated Northern Electric Company, Limited, has taken over the Northern Electric and Manufacturing Company, Limited, and the Imperial Wire and Cable Company, Limited. The business previously carried on by the two latter companies will be conducted by the newly-organized company without change in management.

Nearly four hundred concrete-road builders, engineers and cement representatives attended the First National Conference of concrete-road building in Chicago from February 12 to February 14. Interesting papers were read dealing with the various phases of road building. The lively discussions which followed indicated the great interest taken in the subject.

Catalogue No. 26 issued by the Northern Engineering Works, Detroit, Mich., illuminates and describes electric and hand power travelling cranes, electric and pneumatic hoists, overhead track systems, bucket handling cranes and railway cranes manufactured by this company. The Canadian works of the firm are at Walkerville, Ont., where every facility is provided for handling crane work from the lightest character to the heaviest. The many large and important installations shown in the catalogue attest the reputation of the firm's products.

More than one leading Canadian firm took advantage of the inauguration of the new Parcel Post in Canada, but probably none made so much of the opportunity as The Pedlar People of Oshawa, manufacturers of all kinds of sheet metal products. On the opening date they dispatched to the leading architects, contractors, builders and jobbers throughout Canada, a large number of sample pieces of Pedlar's Square Conductor Pipe. This pipe fits admirably to any style of architecture and is so heavily galvanized as to be unaffected by moisture. Owing to its peculiar construction it will not burst through freezing.

An illustrated descriptive catalogue of the excavating machinery placed upon the market by Messrs. Pawling & Harnischfeger Company, of Milwaukee, Wis., will be of interest to contractors and others who recognize the urgent need of a cheaper method of taking out earth. The machines are described as being of the highest workmanship and combining therewith unusual simplicity and ease in operation. "P. & H." machines are built in various sizes to meet the requirements of different classes of work. The pamphlet is fully informative, containing detailed specifications of the equipment and a full list of sizes and approximate weights. The illustrations are illuminating as to some of the applications of these excavators.

Bond in Brick Work

"Bonds and Mortars in the Wall of Brick," is the title of an attractively-illustrated, informative book received from the Hydraulic-Press Brick Company, makers and distributors of Hy-tex face brick, St. Louis, Mo. The object of the book—and it is admirably fulfilled—is to show the artistic possibilities of the material bound up in the workmanship. It is pointed out that design in brickwork is based upon an accurate knowledge of the mechanical processes of the bond. Especial care is taken to differentiate between bond and pattern. From the same company we have received a copy of "Brick Scale Tables," with explanatory notes for the designer in brickwork. These tables, as well as the booklet "Bonds and Mortars," are designed to eliminate the laborious detail incidental to the preparation of drawings for a brick structure. Too often the designer has been deterred from the use of an otherwise very desirable bond and pattern by the real difficulties that lie in adjusting the brick units to the wall dimensions, and has thus lost one of the finest and subtlest artistic effects which legitimately come within the range of his profession.

The Hydraulic-Press Brick Company are known as the largest makers of face brick in the world. They have fourteen offices and twenty-three manufacturing plants distributed throughout the world.

Making the Truck Pay

By H. D. Pratt, Engineer, Link-Belt Company.

THE motor truck has come to stay. Its ability to carry bulk material long distances in quantities unheard of ten years ago, and at a high rate of speed, makes it possible to materially reduce the cost of transporting large quantities of stone, coal, sand, gravel, etc. The speed of travel is high as compared with the horse-drawn vehicle. The unloading is automatic, the body being dumped by the mere turn of a lever by the truck operator. In many cases the truck is loaded from an overhead chute, but more often the material to be moved lies on the ground in storage piles, not only in regular storage yards, but in streets, roads and wherever most convenient to store. The loading of this

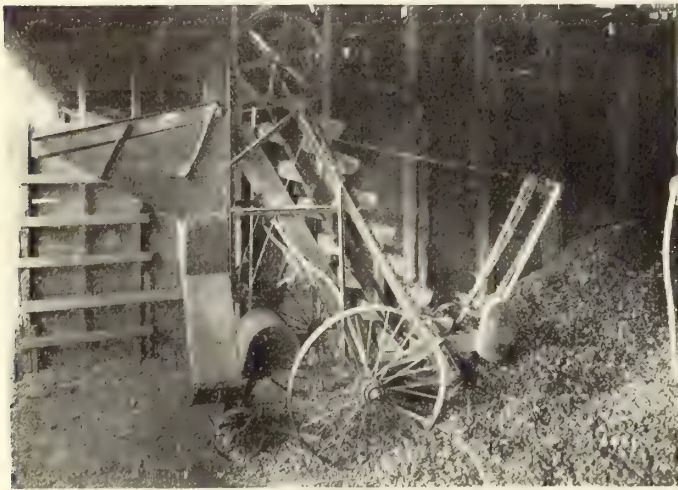


Fig. 1.—Portable wagon and truck loader.

material from ground storage piles becomes a different matter. The high cost of loading auto trucks with material carried on ground storage is one of the factors which have retarded the sale of trucks for this work.

The truck which is so quick and convenient for handling several tons at a load, must necessarily be high to hold the load. Shovelling by hand means that the truck spends more than half its time waiting at the storage pile to be loaded, and between trucks the shovelling gang is idle. A good average day's work for a shoveller is 20 tons of gravel, less of stone, and slightly more of sand. Not only is the truck standing

idle while being loaded, but the loading by hand costs 8 to 12 cents a ton. Here is a bad leak in what should be an up-to-date and efficient job of handling.

The portable wagon and truck loaders effectively stop this leak. Fig. 1 shows how. A bucket elevator is mounted on large wheels, and with power supplied by a motor or gasoline engine, will load sand, gravel or coal at the rate of a ton a minute. The truck driver trims the truck with a shovel, and one, two or three men, depending on the nature of the material to be handled, trim and feed to the loader. This combination will load the truck at a cost of 2½ cents to 5 cents per ton, the higher cost being that of handling crushed stone, with coal at the low end, and sand and gravel following in order. The saving of about 6 cents per ton thus effected is a large item in these days of close margins and competition, and marks the loader as a useful and necessary adjunct of the motor truck.

There is also a growing demand for a further combination of truck and loader, namely, a truck with loader elevator mounted on the rear end of the body, arranged to lower into a storage pile when the truck is backed up to it, and also to raise clear of the ground when not in use. The elevator is supported independently of the dumping body, and is driven, through a clutch, by a connection to the truck transmission. This combination results in a truck which can be loaded by its driver with or without a helper in a few minutes, and does away entirely with the necessity for a loader-operator who is idle between trucks.

The loaders described above are made by the Link-Belt Company, Philadelphia and Chicago.

A concise, attractive catalogue received from Messrs. Canadian Billings & Spencer, Limited, Welland, Ont., shows details of wrenches and machine goods made by this firm and contains an enumeration and description of the other goods manufactured. The business of this concern has developed rapidly since its inauguration in 1907 and this catalogue, the first issued by the company, is of much interest. The various tools are carefully illustrated, concisely described and indexed, and the booklet constitutes a ready reference to the firm's products. In order to finish their forgings to meet the requirements of their customers, the company have installed a powerful electric welding machine which enables them to undertake all manner of electric welding. The equipment of the plant includes bull-dozing and heading machinery.

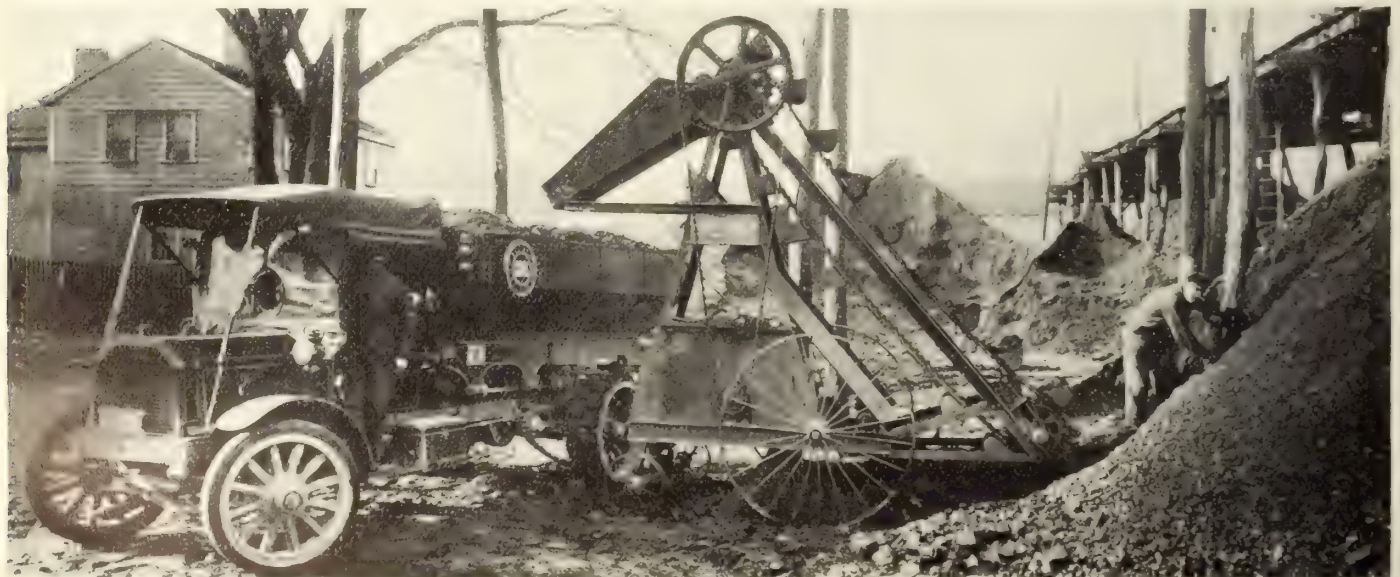


Fig. 2.—Portable wagon and truck loader in operation.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Chicoutimi, Que.

1,000 ft. macadam pavement, 45 ft. wide, 18 in. thick, and clay pipe sewers will be laid on Montcalm street. Engineer-in-charge, J. A. Clareou, City Engineer.

The municipal authorities are about to purchase a steam roller and a crusher.

Drummondville, Que.

Tenders will be received by W. A. Molsan, Sec.-Treas. to the town council, until March 16, for the complete outfit of macadam road machinery. Specifications are at the council offices.

Dundas, Ont.

Engineer, Jno. F. Armour, in his report to the council, recommends that immediate steps be taken towards procuring a site for the sewage disposal plant. A committee has been appointed to secure plans, specifications and estimates.

Edmonton, Alta.

Tenders will be received by the City Commissioners until noon, March 7th, for the supply and delivery to the stores and works, Edmonton, of approximately 228,000 ft. vitrified clay sewer pipe and all necessary specials. Specifications, etc., are at the office of the engineer.

Tenders will be received by the City Comms. until March 12th, for the supply of fire hydrants, gate valves, water meters, pig lead, steel pipe, cast iron pipe. Specifications are at the Waterworks Dept., City Hall.

The city council is considering the expenditure of \$45,000 on the erection of drinking fountains, band stands, etc., in the parks.

Elma Twp., Ont.

Tenders will be received by the township clerk, Geo. Lochhead, Atwood, Ont., until March 7th, for the construction of the "Ellice-Maitland" drain.

Hardisty, Alta.

A site has been secured by the town council for park additions.

Humboldt, Sask.

Tenders in connection with the projected waterworks and sewerage system will be received by W. H. Stiles, Sec.-treas. until 8 p.m., April 15th, for the following: (a) labor laying water mains and sewers; (b) pump house and filter house; (c) furnishing material for, and erecting water tower; (d) furnishing cast iron water pipes; (e) furnishing fire hydrants and valves; (f) furnishing and installing pressure filters; (g) furnishing and installing pumping machinery; (n) furnishing wood stave pipe; (o) laying wood stave pipe; (p) constructing ejector station; (s) furnishing sewer pipes; (x) constructing sewage disposal works.

Plans and specifications at offices of engineers, Toronto and Winnipeg, and at Town Hall, Humboldt, on and after March 16th. Engineers, Chipman & Power, Mail Bldg., Toronto, Ont.

London, Ont.

Tenders will be called in shortly by the Board of Control for castings for manhole tops, etc. Engineer, W. N. Ashplant, City Hall.

Montreal, Que. (St. Lambert)

Surveys have been made, and tenders will be called by Engineer Drinkwater about the end of March for drainage system on different streets.

Ottawa, Ont.

The paving of York street between Dalhousie and King Edw. Sts. is being considered by the City Council; the material has not yet been decided on.

The sum of \$40,000 was included in the estimates of the Waterworks Dept., for hydrants and meters.

The city council has under consideration the installation, at a cost of \$25,000, of a trunk sewer to drain the north-east portion of the Rideau Ward.

The city council is about to repave Rideau street between Sussex and Dalhousie streets; the approximate quantities are asphalt, 6,408 sq. yds.; blocks, 2,140 yds.; gutter, 2,136 lin. ft. Estimated cost \$31,000.

New Toronto, Ont.

Messrs. James, Loudon & Hertzberg, 79 Adelaide street west, Toronto, have been engaged by the municipality to design and take tenders for a complete waterworks installation estimated to cost \$50,000.

Preston, Ont.

The town council is considering certain alterations and extensions to the waterworks system.

Riviere du Moulin, Que.

The municipal council are about to purchase a steam roller and a crusher.

Regina, Sask.

The ratepayers will vote on a by-law March 11th for the provision of funds for the laying of storm water sewers.

The ratepayers will vote on a by-law March 11th. Money is to be raised for extension of the waterworks system and the acquisition of a right of way in connection therewith.

Victoria, B.C.

The municipal council will probably call tenders for a paving plant of a semi-portable type.

Vancouver, B.C.

The Engineer has asked that the purchasing agent be authorized to call for tenders for sewer pipe for 1914. The or-

der includes 69,000 ft. pipe and about 850 junctions.

Windsor, Ont.

Tenders for a brick sewer on Dougal Ave. will be received by Ed. Brian, City Engineer, until March 10th.

Winnipeg, Man.

The Provincial Government has voted the sum of \$2,500,000, to be used under the provisions of the Good Roads Act just passed.

CONTRACTS AWARDED

Le Pas, Man.

A contract has been awarded by the town council to A. G. Sangster, for putting in an intake for the new waterworks system.

Riviere du Moulin, Que.

The contract for the construction of gravel and macadam road has been awarded by the Municipal Council to P. Laberge, Riviere du Moulin, \$19,800.

Sydney, C.B.

The contract for pipe for the water-main extension has been awarded by the city council to Canada Iron Corporation, Londonderry, N.S.

Toronto, Ont.

The following contracts for sewers have been awarded by the Board of Control. Grant Contracting Co., Front St. E., Medland street, \$2,450; Maher street, \$760; Caledonia Rd., \$9,995; Vernon St., \$974. Commr. of Works, by day labor, Danforth Ave., \$30,200; McRoberts Ave., \$6,810; Rhodes Ave., \$13,400. Asphaltic Concrete Co., 74 King E., Barber Ave., \$1,795; Gilmour Ave., \$6,385. National Contracting Co., 9 Garnock Ave., Swanwick Ave., \$5,988. W. E. Taylor, Kenilworth Ave., \$1,766. J. O. Jerou, 90 Curzon St., Midway Dist. sewage outlet, \$68,000. J. H. McKnight Co., 88 St. David St., Highfield Rd., \$2,437; Walter St., \$1,463; Lee Ave., \$8,464. E. Axworthy, Aziel St., \$1,260; Mavety St., \$2,300; Pacific Ave., \$1,900. W. R. Hunter, Heyworth Cres., \$848. National Contracting Co., 9 Garnock Ave., Christie St., storm overflow sewer at \$10.95 per lin. ft., segment block construction.

Winnipeg, Man.

The following contracts have been awarded by the Board of Control to J. W. Astley, Engineer of Construction, for sewer in Borebank street and Seymour street, at \$1,078; sewer in Garwood Ave. at \$721; sewer in Manitoba Ave. at \$697.10, and Magnus Ave. at \$517.

The following contracts have been awarded in connection with the Greater Winnipeg Water Dist. Steel Corporation of Canada, Ltd., 913 Union Bank Bldg., for steel splice bars; E. G. Bawif, 617 Grain Exchange Bldg., for clearing right of way at \$50,000; J. F. McInnes for 3 dwellings; United States Steel Products Co., 402 Trust & Loan Bldg., for

spikes, bolts, switches, frogs and track accessories; Algoma Steel Corporation, 334 Somerset Bldg., for steel rails; Northern Constr. Co., Union Bank Bldg., for grading and laying out about 85 miles, 60 lbs., 4 ft. 8½ in. steel rails at \$500,000.

Railroads, Bridges and Wharves

Province of Alberta

The sum of \$11,000 has been included in the estimates for improvement to the channel of the Athabasca River.

Province of B. C.

A charter has been granted to D. A. Thomas, Cardiff, Wales, for the construction of 1,500 miles railroad from the mouth of Ness River, eastward through B. C. and the Peace River country.

Cheverie, N.S.

Tenders for extensions to the wharf will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. March 16th. Plans, etc., at offices of the Dist. Engineers, Halifax, Antigonish, N.S., Postmaster, Cheverie, and at the Dept., Ottawa. Wharf to be completed by or before December, 1914.

Chicoutimi, Que.

Surveys have been made with a view to an extension of 500 feet to the wharf and tenders will be called in the spring. Engineer-in-charge, P. Amiot.

Comeau's Cove, N.S.

Tenders for the construction of a breakwater will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until March 25th. Plans, etc., at the office of the Dist. Engineer, Halifax, N.S., Postmaster, Digby, N.S., and at the Dept., Ottawa.

Edmonton, Alta.

Plans have been drawn for the construction of a bridge across Narrows of Lesser Slave Lake at Grouard.

Esquimalt, B.C.

Plans have been drawn by The Canadian Puget Sound Sawmill Co., Ltd., for a wharf at Thetis Cove, Esquimalt Harbour.

Fitzroy Twp., Ont.

Plans have been drawn for a highway bridge over Mississippi River. The work consists of concrete abutments and piers, 2 steel spans of 110 ft. each, and tenders will be called in a few days. Plans are in progress for a second bridge. Engineer-in-charge, D. Barrie, 357b Elgin St., Ottawa.

Fredericton, N.B.

Plans have been drawn by the St. John & Quebec Railway Co., for new bridges to be erected over River de Chute.

Gainsboro Twp., Ont.

The Twp. Council has under consideration the construction of 2 bridges each 1 span, 50 ft. x 12 ft. and 54 ft. x 12 ft.

Melfort, Sask.

The construction of a station and freight sheds is being considered by the C. N. Ry.

Ottawa, Ont.

Plans for the Pretoria Ave. bridge are being rushed. The Govt. has granted \$40,000 towards the cost.

Prince Albert, Sask.

The sum of \$19,000 has been included in the estimates for the construction of wharf and protection works.

Port Dover, Ont.

Plans have been drawn by the Norfolk County Council for a bridge over the Lynn River. Clerk, E. Boughner, Simcoe, Ont.

Soperton, Ont.

The authorities of the Twps. of Leeds and Lansdowne are considering the construction of a bridge across the Gananoque River.

St. Thomas, Ont.

Representatives of St. Thomas, Aylmer, Yarmouth and Malahide, have agreed to guarantee the bonds of the London & Lake Erie Ry. Transportation Co., if they will extend their line from St. Thomas to Aylmer and from Union to Sparta. The ratepayers are to vote on the necessary by-law shortly.

Toronto, Ont.

Tenders will be received by the Harbor Comms., until March 9th, for retaining walls, Don Diversion. Plans, etc., at office of Comms. Sec., A. C. Lewis, 50 Bay street.

Weyburn, Sask.

The city council are considering the construction of a lumber and rock dam at the Souris River.

Winnipeg, Man.

Tenders will be received by the Board of Control for the supply of a locomotive complete with tender and snow plow. Specifications at the office of the Engineer, 54 King street.

CONTRACTS AWARDED

Callender, Ont.

The contract for extensions to the wharf has been awarded by the Public Works Dept., to D. Darling, Callender.

Heustis Landing, N.B.

The contract for the construction of the wharf has been awarded by the Public Works Dept. to Melvin Jones, Cambridge, N.B.

Hamilton, Ont.

The following contracts have been awarded on the McKittrick bridge: Excavating, grading, building concrete piers and approaches, MacKay-Paulin Construction Co., Ltd., Bank of Hamilton Bldg., at \$33,794; steel work, Hamilton Bridge Works Co., Ltd., Barton and Bay Sts., at \$76,625.

Winnipeg, Man.

Contract has been awarded by Board of Control, Sec., M. Peterson, to Canadian Westinghouse Co., Ltd., Portage Ave., for switching gear and accessories for King St. sub-station at \$16,828. Engineer, J. G. Glassco, 54 King St.

Public Buildings, Churches, Schools, etc.

Aurora, Ont.

Tenders for the erection of post office and customs house will be received by R. C. Desrochers, Sec. Public Works Department, Ottawa, until March 16th. Plans, etc., at the office of Thos. Hastings, Clerk of Works, Postal Station "F,"

Yonge St., Toronto, Post Office, Aurora, and at Dept., Ottawa.

Bancroft, Ont.

Tenders for a school, to cost \$8,000, will be received by I. A. Eby, School Board Secretary, until March 7th. Plans and specifications are at the Bancroft Drug Store.

Bird's Hill, Man.

Tenders will be received by School Board Sec.-Treas., W. Gorham, until 6 p.m. March 11th, for all work and material in connection with the erection of a 2-roomed school. Plans and specifications at residence of Capt. J. M. Smith. Stone and brick construction.

Berlin, Ont.

The Rev. J. A. Miller, 18 Victoria Ave. S., Hamilton, is interested in the proposed erection of a college here, for which plans are now being drawn.

Dartmouth, N.S.

Tenders for the erection of a public building will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. March 12. Plans, specifications, etc., at the office of Wm. Bishop, Supt. of Bldgs., Halifax, N.S., Post Office, Dartmouth, and at the Dept., Ottawa.

Daysland, Alta.

The School Districts of Fertile, Oure, Leith and Baetman contemplate having a Consolidated School. Further information can be had from Mr. Ottewell, University of Alberta, or Chairman Daysland School Board.

East Gwillimbury Twp., Ont.

Tenders for the erection of a school are invited by W. F. Holborn, Raven-shoe, Ont., Sec. School Sec. No. 9, until March 14th. Plans with the Sec. or at the office of G. H. Phillips, architect, Newmarket.

Edmonton, Alta.

The erection of an auditorium, at a cost of \$30,000, is being considered by the city council, and the matter has been referred to a committee consisting of Parks & Market Dept., Commr. Chalmers and G. M. Hall, City Hall.

The construction of swimming baths at Syndicate Ave. and Boyle St., has been approved by the city council and will be submitted to the ratepayers in the spring.

Ft. Francis, Ont.

Plans and specifications have been approved for the erection of the armory on Scott street.

Fort William, Ont.

The erection of a Sunday school, at a cost of \$40,000, is proposed by the congregation of St. Andrews Presbyterian Church.

Hamilton, Ont.

Plans are in progress for a new Church for the Ryerson Methodist Church Congregation, Main St. E. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. Estimated cost, \$40,000.

Stewart & Witton, architects, 2 Hughson St. S., have plans in hand for the erection of a hospital on the Mountain top. The estimated cost is \$200,000.

Lethbridge, Alta.

A site has been secured and plans are

to be prepared for the erection of a public library.

Listowel, Ont.

A site with a frontage of 50 ft. has been donated for the erection of a Y. M. C. A. building.

Millgrove, Ont.

The erection of a public school is contemplated by School Sec. No. 7. Sec.-Treas., John H. Allison.

Montreal, Que.

The Young Men's Hebrew Assn. are looking for suitable site for the erection of a club house. Chairman of Bldg. Com., L. Cohen, 36 Prince.

Nelson Twp., Ont.

Tenders for the erection of a school, to cost \$12,000, will be received by Colin Smith, School Sec., Sec. No. 15, Burlington, until March 7th. Plans with the Sec., at the office of architect, and at John T. Matthew's store, Burlington. Mills & Hutton, Bank of Hamilton Bldg., Hamilton, architects.

Oak Ridges, Ont.

Plans have been drawn, and \$8,000 is to be raised shortly, for a 2-room school, to be erected this summer.

Oshawa, Ont.

At a meeting of the Board of Education it was decided that the Property Committee be instructed to procure plans and specifications for a new 8-room school.

Ottawa, Ont.

The renovation of Knox Presbyterian Church is being considered. A plan for reseating will be included.

Fire Chief Graham recommends the erection of fire stations at western end of St. Georges ward; at the corner of Bank and McLeod streets; and at the corner of Hawthorne and Main streets. The council will consider the matter shortly.

The Board of Control has decided to go ahead with the prison farm scheme. Mr. McCluff, City Auditor, and Mr. Keane, Charity Officer, are to consider a few sites and report to the Board of Control.

Paisley, Ont.

The Public School Board propose to erect a new school to replace the building recently destroyed by fire.

Prince Rupert, B.C.

The Daughters of the Empire, of whom Mrs. J. C. McLennan is regent, propose to erect a lodge hall.

Queenston, Ont.

Tenders for the erection of a school are called by A. E. Nicholson, 46 Queen street, St. Catharines, until 5 p.m. March 15th for all tenders. Plans at office of Architect, F. H. Shepard's general store, Queenston, and at office of Hugh C. MacLean, Ltd., 220 King St. W., Toronto.

Regina, Sask.

The erection of a school on 14th Ave., to cost \$25,000 is being considered by the Separate School Board.

St. Mary's, Ont.

The sum of \$42,000 having been granted by the council, a central school will

now be built without submitting the matter to the ratepayers.

Simcoe, Ont.

A club house is contemplated by the Norfolk Country Club, and the following committee has been appointed: H. B. Donly, Geo. J. McKie, F. Reid, W. C. J. King and F. E. Curtis.

Sydney, N.S.

Tenders for the erection of a \$25,000 hospital will be called by the City Council about April 1st.

St. Thomas, Ont.

A site on Flora street for the erection of a manual training school has been purchased by the Board of Education.

Toronto, Ont.

Plans are being prepared by the Board of Education for a new building to be erected to replace the present one on St. David street, and also for one on Sackville street.

Plans are being prepared for a \$100,000 church on Grace and Mansfield streets, for St. Francis R. C. Congregation. Architect, A. W. Holmes, 10 Bloor St. E.

Vancouver, B.C., Grandview

It is proposed to erect a new Orange Hall, at a cost of \$18,000 to \$20,000.

Vernon, B.C.

Plans are in progress for the erection of a college for the Colonial Intelligence League. Estimated cost \$7,000.

Walkerville, Ont.

Tenders for the erection of a public building will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until March 16th. Plans and specifications at the Post Offices, Walkerville and London, and at the Dept., Ottawa.

Tenders for the erection of a post office, to cost \$90,000, will be received by R. C. Desrochers, Sec. Public Works Department, Ottawa, until March 16th. Plans at Post Offices, London and Walkerville, and at the Dept., Ottawa.

Wheatley, Ont.

The Methodist Church Congregation propose to erect a new church at a cost of \$15,000.

Whitney Pier, N.S.

Tenders will be called in about 30 days for the erection of a new church for the R. C. Church Congregation.

Winnipeg, Man.

Tenders will be received by the Board of Control until March 18th, for replacing old wooden floors with reinforced concrete at Fire Stations Nos. 1, 3, 4, 5, 6, 7 and 8.

The following items were included in the estimates of the Public Works Dept., Barracks, \$150,000; railway postal station, \$100,000; postal station, \$75,000; drill hall, \$75,000; improvements to the immigration building, \$3,000.

Wolfville, N.S.

Tenders for the erection of a church, on Main Street, for the Presbyterian Church Congregation, will be received for all trades but stone. Architect, A. R. Cobb, Roy Bldg., Halifax.

CONTRACTS AWARDED

Brussels, Ont.

The following contracts have been

awarded by the Melville Presbyterian Church. General contractor for church, John Hunter, Cranbrook, \$21,000 (contract does not include fixtures, glass and seating, which are to be let later). General contractor for sheds, Hunter & Barkley, Brussels, \$4,000. Architect, J. S. Russell, 21 Downie St., Stratford.

Halifax, N.S.

A contract for alterations and interior fittings to the public building, has been awarded by the Public Works Dept., to Thomson & Theakston, 24 Cherry St.

Jonquiere, Que.

The contract for the erection of a church for La Corporation Catholique, has been awarded to Jos. Giroux, 95 Desfosses St., Quebec. Architect, J. P. Lemay, 19 Rue d'Aiguillon, Quebec.

Kelowna, B.C.

The contract for the erection and furnishing of the maternity hospital has been awarded to G. Ritchie.

La Salette, Ont.

The following contracts have been awarded in connection with the building of the R. C. Church. General contractor and carpenter, B. Blonde, Chatham. Mason, C. C. Liley, 558 Ontario St., London. Iron and steel, Dennis Wire & Iron Works Co., Ltd., 22-26 Dundas St., London. Roofing, Brown-Jarvis Roofing Co., 9 George St., Brantford. Painting not let. Heating, F. I. Duggan, 60 Huron St., Stratford. Electric fittings, Davis Acetylene Co., Buttrey St., Niagara Falls. Interior fittings, Snyder Bros., Upholstering Co., Ltd., King St., Waterloo.

Montreal, Que.

The following sub-contract has been awarded in connection with the foundling hospital. Steel, Dom. Bridge Co., Lachine. The general contractors, Anglins, Ltd., invite tenders on roofing.

Orillia, Ont.

The following sub-contracts have been let on the addition and alterations to the post office: General contract, E. Webb & Son; heating and plumbing, the Orillia Hardware Co.; electrical, Ritchie & Ritchie.

Summerside, P.E.I.

The contract for addition and alterations to public building has been awarded by the Public Works Dept., to Harvey P. Wood, Summerside.

Swift Current, Sask.

The following contract on the central public school has been awarded. General contractors, Read, MacDonald & Brewster, 613 Tegler Block, Edmonton. Plumbing and heating, Frost Bros., 77 High W., Moose Jaw.

St. John, N.B.

Kane & Ring, West St. John, have been awarded the contract for the erection of the Detention building on Partidge Island.

Toronto, Ont.

The following contracts have been awarded on the Administration building. Ross and College streets for the National Sanitarium Assn. Architects, C. S. Cobb and F. A. Spangenburg, 71 Bay Street. Mason, Teagle & Son, 55 Boswell Ave. Carpenter, Thos. Painter & Son, 333 Huron St. Plumbing, Purdy, Mansell, Ltd., 63 Albert St. Plastering, R. C.

Dancy, 153 Spadina Rd. Ornamental iron, McGregor & McIntyre, 1139 Shaw street. Marble, J. G. Gibson, Marble & Granite Co., 57 Winchester street. Roofing, Geo. M. Bryan, 524 Yonge street. Electric wiring, McDonald & Wilson, 12 Queen E. Cut stone, Nicholson & Curtis, 1117 Yonge street. Elevator and painting contract not yet awarded.

Tillsonburg, Ont.

The following contracts have been awarded in connection with the public library. General contractors, Nagle & Mills, Ingersoll. Masonry not let. Carpentry, West & Jackson. Heating, C. W. Conn. Painting, H. Weatherwax, Hale street.

Yorkton, Sask.

The contract for the Evangelical Lutheran College has been let and work is to be started this year.

The following contracts for the Ruthenian Church have been awarded. General contractors, Logan & Black. Painting and decorating, Furlly & Son. The other contracts are not yet awarded. Architects, Munro & Mead, Yorkton.

Business Buildings and Industrial Plants

Barrie, Ont.

The Dominion Realty Co., Ltd., 34 King St. W., Toronto, are about to erect a bank building on Dunlop St., for occupation by the Canadian Bank of Commerce.

Calgary, Alta.

The erection of a 10-storey stores and office building at a cost of \$165,000, is contemplated by Hubble & Kelley, 6th Ave. and Centre street.

Alex. Pantages Seattle, Wash., U.S.A., is looking for a site suitable for the erection of a \$250,000 theatre.

Edmonton, Alta.

Geo. Brown, President of the Empire Hotel, 2nd street, proposes to make certain additions, work on which will start about June 1st.

Eganville, Ont.

The Standard Chemical, Iron & Lumber Co. are considering the erection of a sawmill here.

Fort William, Ont.

Elevator additions, at a cost of \$15,000, are being considered by Black & Muirhead, Ft. William West.

Grand Lake, Victoria, Que.

Fraser & Co., 74 Nepean St., Ottawa, are contemplating removing their Deschenes mill when the North Rly. Co. build their line between Montreal and a point on the G. T. P.

Grimsby, Ont.

Tenders for a winery, to cost \$15,000, for the Pele Island Wine & Vineyard Co., Brantford, will be received by Architect, Jos. Daw, 165 St. Paul St., St. Catharines. Plans at office of architect and K. Vine's Estate Office, 138 Victoria St., Toronto.

Hamilton, Ont.

Plans for stores and apartment house, on King St. E., for Bennett & Thwaites, have been drawn by Architects, Watt & Blackwell, Lister Chmbrs. Sub-contracts will be let privately by the owners. Estimated cost \$42,000.

Listowel, Ont.

Tenders will shortly be called for a condensed milk factory to cost \$50,000, for the Dry Powder Milk Co., Ltd.

Medicine Hat, Alta.

Preliminary plans for an office building for E. D. Bennet are being prepared, and will be started this year.

A site on Ottawa St. for the erection of a clothing factory has been purchased by Murdock McLeod, 708 Main St., Moncton, N.B.

Melfort, Sask.

Allsen & Johnson are about to erect a 2-storey machine shop.

Montreal, Que.

A permit for the erection of store and flats on St. Antoine St., at a cost of \$10,000, has been issued to R. Laberge, 141 Convent St. Architects, Charbonneau & Audet, 15 St. James St.

Tenders for addition and alterations to hotel, Windsor St., are all in, but contracts will not be let for some time. Architect, D. J. Crighton, Jacobs Bldg., St. Catherine W.

The erection of a grand stand is proposed by the Montreal Baseball Club. Pres., S. E. Lichtenhein, 173 Common St.

Montreal, Que., Maisonneuve

Sub-tenders on the store and manufacturing plant for A. Michaud, Quebec Bank Bldg., Montreal, will not be called till March 15th.

New Westminster, B.C.

The mill of the Westminster Woodworking Co., Lulu Island, recently destroyed by fire, with loss of about \$75,000, will be rebuilt at once.

Niagara Falls, Ont.

M. Slingerland, Queenston, Ont., has purchased a site for the erection of a store, garage and repair shop.

North Battleford, Sask.

D. F. Stewart will probably erect a creamery at a cost of \$10,000.

Ottawa, Ont.

Thomas Clarey, Centre St., has purchased a site with 100 ft. frontage on Bank St. for the erection of a commercial building.

Plans for the erection of a \$25,000 building on Rideau and Waller streets, for the Bank of Ottawa, are being drawn by J. P. MacLaren, 104 Sparks street.

Princeton, B.C.

The B. C. Portland Cement Co., Ltd., contemplate adding another unit to their plant, practically doubling present output of 677-700 bbls. per day to 1,200-1,500 bbls.

Prince Albert, Sask.

Mr. Felix Frank contemplates erecting a factory to produce nitrogenous fertilizers and other chemical substances.

Red Deer, Alta.

B. F. Akerman, 201 George St., Peterboro, Ont., contemplates erecting a wholesale distributing warehouse for harness and horse clothing.

Regina, Sask.

A permit for 6 stores on Victoria and Smith, to cost \$20,000, has been granted to Wilson & Wilson, Westman Chmbrs.

A permit for 7 stores on Scarth and

12th St., to cost \$25,000, has been granted to McCallum & Hill, 106-112 McCallum Hill Block.

The Orpeum Vaudeville Circuit, Sullivan Considine, 42nd and 6th Ave., New York, N.Y., has under consideration the erection of a theatre at a cost of \$100,000.

Sarnia, Ont.

The Nye Odorless Crematory Co., Atlanta, Georgia, U.S.A., contemplate erecting a factory for the manufacture of incinerators.

Stratford, Ont.

The loss that the Wood Mosaic Co., Inc., New Albany, Ind., recently sustained by fire at Louisville and Albany, is much greater than they at first supposed, and nothing further will be done in regard to proposed factory for probably a year or more.

Sydney, N.S.

R. Christie & Sons, Esplanade, are considering the erection of a cold storage and freezing plant.

Sherbrooke, Que.

Plans for a business block on Wellington street, are being drawn for A. Chevalier.

Souris, Man.

Mr. D. McEarchern, 1st Ave and Snowden Street, contemplates building a garage on the site of the warehouse recently destroyed by fire.

St. Boniface, Man.

The William Galloway Company has purchased a site for the erection of an agricultural implement plant.

Toronto, Ont.

Plans for alterations to stores located at 254-254½ Yonge St., have been drawn for Copley Noyes & Randall, 188 Duke St. Estimated cost \$10,000.

Youngs Lunch Co., Hartford, Conn., has purchased a site on N.E. Cor. Yonge and Queen Sts. The present building will be remodelled.

L. J. Applegath, 179 Yonge St., has plans drawn for alterations to the store estimated to cost \$5,000.

Tenders for bank and office building at the corner of Yonge and Queen, for the Imperial Bank of Canada, will be received by Darling & Pearson, architects, 2 Leader Lane, until March 14th.

Geo. S. McConkey, 29 King St. W., has purchased a site on Queen street, near Bay street, and proposes to erect a restaurant thereon.

Vancouver, B.C.

J. J. Donnellan, 319 Pender St. W., has been appointed architect for the proposed \$250,000 Pantages theatre.

The Cascade Laundry will call tenders shortly for the erection of a building, 3 storeys, 104 x 78, reinforced concrete construction.

Plans are in progress, and tenders will be called shortly for addition and alterations to Orange Hall, Hastings St. E. and Gore Ave. Estimated cost \$40,000.

Welland, Ont.

The Welland Lumber Co., Ltd., has secured a site for the erection of a sash and door factory.

Windsor, Ont.

Tenders will be called shortly for the

erection of the new Windsor Hotel. Architects, J. L. Wilson & Son, Penabscat Bldg., Detroit, Mich., and Cahtham, Ont.

Winnipeg, Man.

Interior alterations, to cost \$5,000, are being considered by the proprietors of the Queens Hotel, Portage Ave. Architects, Pratt & Russ, 1011 Elec. Bldg., Chmbrs.

Architect is receiving private tenders for completion of the hotel on Smith St., for the Olympia Cafe Co. General contractors, Carter, Halls & Aldinger.

CONTRACTS AWARDED

Chicoutimi, Que.

The contract for the construction of a skating rink has been awarded by La Cie du Patinor, Chicoutimi, to A. Pednault.

Hamilton, Ont.

The contract for masonry in connection with the alterations to the store of A. M. Souter & Co., King St. W., has been awarded to Geo. E. Mills, 614 King St. E.

The following contracts for addition to the store of Stanley Mills & Co., have been awarded. Architects, Mills & Hutton, Bank of Hamilton Bldg. Mason, S. Howard, 231 Mary (day work). Carpenter, J. Mercer, 195 Hunter St. E. (day work). Iron and steel, Hamilton Bridge Works, Stuart St. W. Steel sash, Trussed Concrete Co., Walkerville, the other contracts are not let yet.

Montreal, Que.

The following contracts have been awarded in connection with the alterations to the Canada Office Furniture Co.'s premises, Notre Dame St. Architects, Peden & McLaren, 20 St. Alexis St. General contractor, Jno. Allen, 300 Atwater. Steel, Phoenix Bridge Co., 83 Colborne. Elevator, Otis, Fensom Elev. Co., 368 St. James. General contractor will call tenders shortly on heating, plumbing and electric.

Sub-contracts on alterations to the Imperial Oil Co.'s premises have been let as follows: General contractors, Jas. Shearer & Co., 225 St. Patrick. Heating and plumbing, L. E. Moulton, 955 St. James. Electrical, Elec. Repair & Construction Co., 119 Lagachetiere W.

Olds, Alta.

The contract for sinking 11 oil wells, for the Monarch Oil Co., has been awarded to General contractors, The International Supply Co., Medicine Hat.

Orillia, Ont.

The following contracts have been awarded in connection with remodelling of the F. W. Woolworth Co., Ltd., store. General contractors, E. Webb & Son, Orillia. Painting, Frank Toogood. Heating and plumbing, The Orillia Hardware Co. Electrical, Ritchie & Ritchie. Interior fittings, J. R. Eaton & Sons.

Ottawa, Ont.

The contract for electric fittings in connection with the alterations to the factory of Jas. Hope & Son, Sparks St., has been awarded to J. H. Byrnes, 86 Henderson street.

The contract for alterations to Hugh Carson's store on Nepean street, has

been awarded to Victor Hall, Cooper street.

Port Edward, Ont.

The contract for coal chutes has been awarded by the Northern Navigation Co. to Grace & Guttridge, Chatham.

Regina, Sask.

The contract for the erection of 7 stores on Scarth St. and 12th Ave., for McCallum Hill & Co., Ltd., has been awarded to General contractors, Wilson & Wilson, Westmann Chmbrs. Architects, Story & Van Egmond.

Sarnia, Ont.

The following contracts have been awarded in connection with the office building, alterations and addition for the Industrial Mortgage & Savings Co. Architect, Russell W. Soper, 151 North Vidal St. Cement, carpentry, painting and glazing, Thos. Grace, 317 Wellington St. Cut stone, Geo. Paul, 156 Victoria St. The heating and plumbing is not yet let.

Sherbrooke, Que.

The contract for the erection of a restaurant, on Wellington Street, for Arthur Chevalier, 31 Brook St., has been let to general contractor, Sherbrooke Constr. Co.

Toronto, Ont.

The contract for the erection of the Holbrooks, Ltd., warehouse, on Florence St., has been awarded to General contractors, Raymond Constr. Co., Ltd., 43 Victoria St. Architects, T. Pringle & Son, Ltd.

Winnipeg, Man.

Carter, Halls & Aldinger Co., 1010 Union Bank Bldg., have secured the contract for the completion of the hotel building on Smith St., for the Olympia Cafe Co. Architects, Jas. Chisholm & Sons, 310 Enderton Bldg.

Windsor, Ont.

The following contracts have been awarded on the repairs to the King George Hotel. Carpentry, Thos. Sutherland; painting and interior fittings, T. W. Brooke & Son.

Residences

Berlin, Ont.

The Berlin Housing Co., Ltd., has under consideration the erection of 50 houses for which the city council will be asked to guarantee \$100,000 bonds.

East London, Ont.

The contract for the erection of 100 residences, on Dundas, for the McCormick Mfg. Co., has been awarded to Frost & Winchester Co., Detroit, Mich.

Farnham, Que.

The contract for the erection of semi-detached residences on the Experimental Farm have been awarded by the Public Works Dept., to A. B. Comeau, Farnham.

Hamilton, Ont.

Plans are being prepared for a \$6,000 residence, on Emerald St. S., for J. E. Dodson, 116 West Ave., N. Architects, McPhie, Kelly & Darling, Bank of Hamilton Bldg. Tenders will be called shortly.

Plans for two residences to cost \$5,000 and \$10,000 respectively, are being drawn

by Grayson W. Brown, architect, Clyde Block, who also has plans in progress for a \$75,000 apartment house.

Tenders for an apartment house on James Street South to cost \$15,000 are invited by W. G. Brown, architect, Clyde Block.

Plans for the apartment house, on Bay St., for McPhie & Donaldson, are being revised by McPhie, Kelly & Darling, Bank of Hamilton Bldg.

The erection of the residence, on Hillcrest Ave., for Wm. Gillespie, 25 Emerald St. S., has been postponed for the present.

H. Dunham, 719 Cannon E., proposes to erect ten residences, costing \$5,000 each, on Rosemount Gardens.

Hines & Vokes, 206 Hughson N., have plans in progress for the erection of an apartment house on St. Matthews Ave., at a cost of \$25,000, for R. Press & Son, 142 Ferguson Ave. N.

Hudson, Que.

Architect, H. Dunlap Morrison, 454 Old Birks Bldg., Montreal, is drawing plans for a \$5,000 residence for A. Charlebois, and will receive tenders about March 15th for general contractor.

London, Ont.

Plans for the erection of 20 residences, at a total cost of \$35,000, are being drawn by Wm. Copp, 83 Bryon Ave.

Montague, P.E.I.

C. B. Chappell, Box 93, Charlottetown, has plans in progress for a residence for J. W. Carruthers.

Montreal, Que.

A permit for the erection of 14 flats, on Forsythe St., at a cost of \$8,000, has been granted to Jos. Tremblay, 419 Forsythe.

A permit has been issued for alterations to the residence of Ferdinand Quevillon, 470 Beaulieu, at a cost of \$10,000.

Tenders for all trades in connection the erection of an apartment house, on St. Hubert and Johnson Sts., for Mr. Langlois, 84 Cherrier St., are invited by Marius Dufresne, architect, Ontario St., Maisonneuve.

A permit for 9 flats, on Cartier, has been issued to N. Levesque, 786 Dorion street.

Montreal, Que., Maisonneuve

Marius Dufresne, Ontario St., architect, has been appointed to draw plans for 600 workmen's residences, and submit same to council about March 15th. If passed, tenders will probably be called.

Montreal, Que., Rosemount

P. H. Richardson and W. D. Chambers, 299 St. James St., are receiving tenders for the erection of twenty residences. Estimated total cost \$80,000.

Montreal, Que., Notre Dame de Grace

Chas. Fyfe, 137 Park Ave., Montreal, has under consideration the erection of 12 residences.

Ottawa, Ont.

William Baird, 228 Frank St., proposes to erect a \$5,000 residence on Powell St.

Plans for a residence, on O'Connor St., for G. F. Hodgins, 344 Frank, have

(Continued on page 84)

Tenders and For Sale Department

Tenders

Tenders will be received by the undersigned until 5 p.m., **March 15th, 1914**, for all trades required in connection with the erection and completion of a new Public School Building to be erected in the Village of Queenston, Ont. Plans and specifications may be seen at the office of the Contract Record, Toronto; F. H. Shepherd's General Store, Queenston, Ont., and A. E. Nicholson's office, 46 Queen Street, St. Catharines, Ont.

The lowest or any tender not necessarily accepted.

A. E. NICHOLSON, O.A.A., Architect,
46 Queen Street,
St. Catharines, Ont.

CITY OF NORTH BATTLEFORD SASKATCHEWAN

Tenders for Cast Iron Pipe and Sewer Pipe

Sealed tenders marked "Tenders for Sewer Pipe," or "Tender for Cast Iron Pipe," will be received by the City Commissioners till 12 o'clock noon, **Monday, March 16th, 1914**, for furnishing the City of North Battleford with cast iron water pipe and vitrified tile sewer pipe for the year 1914 in accordance with the specifications on file at the offices of the Engineers, Messrs. Chipman & Power, Mail Building, Toronto; 47 Canada Life Bldg., Winnipeg; and at North Battleford, Sask.

The lowest or any tender not necessarily accepted.

J. A. FOLEY,
H. W. DIXON,
J. B. STIRLING, City Commissioners.
CHIPMAN & POWER, Engineers,
Toronto and Winnipeg.
North Battleford, Feb. 17, 1914. 8-9

CANADIAN PACIFIC RAILWAY COMPANY DEPARTMENT OF NATURAL RESOURCES ENGINEERING BRANCH

TENDERS FOR CONCRETE CONSTRUCTION

Sealed tenders, addressed to the undersigned and endorsed "Tenders for Concrete Structures," will be received up to noon of **March 14th, 1914**. The work to be let includes the concrete (Irrigation) structure in about half of the area comprising the Eastern Section of the Company's Irrigation Block, Alberta. Materials, except for forms, will be furnished by the Company. Materials for forms and all labor must be furnished by the Contractor. The approximate quantities are:—3,800 cubic yards of concrete and 192,000 pounds of reinforcing steel. The quantities in individual structure vary from 15 cubic yards to 80 cubic yards.

Plans, specifications, and full information will be furnished on application to the undersigned. A deposit of \$50.00 will be required before plans, etc., will be given out, which will be refunded on their return in good condition.

All proposals must be accompanied by a certified cheque, payable to the undersigned, for five per cent. of the amount of the tender, to be forfeited as liquidated damages should the bidder neglect or refuse to enter into a contract in the event that the work is awarded to him.

Proposals must be made on the standard form provided. Alterations thereto, interlineations or qualification of prices may invalidate the bid.

The right is reserved to reject any or all bids and to waive defects.

A. S. DAWSON,
Chief Engineer.
Calgary, Alberta. 7-9



Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Aurora, Ont.," will be received at this office until 4 p.m., on **Monday, March 16, 1914**, for the above mentioned work.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Aurora, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering declines to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, February 20, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—55944. 8-9



Sealed tenders addressed to the undersigned, and endorsed "Tender for Public Building, Walkerville, Ont.," will be received at this office until 4 p.m., on **Monday, March 16, 1914**, for the above mentioned Public Building, Walkerville, Ont.

Plans, specification and form of contract can be seen and forms of tender obtained at the Post Office, London, Ont., at the Post Office, Walkerville, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering declines to enter into a contract when called upon to do so, or fails to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, February 20, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—55946. 8-9

CITY OF LONDON, ONT.

Tenders for Supply of Road Oil and Sprinkling Equipment

Sealed tenders addressed to the "Chairman and Members of the Board of Control," will be received at the office of the City Clerk until 5 p.m. on **Thursday, the 13th March, 1914**, for the supply of:—

125,000 Imperial Gallons No. 4 Standard Asphaltic Road Oil.
Two Road Oil Pressure Sprinklers.

Specifications and all particulars can be obtained at the office of the City Engineer.

The lowest or any tender not necessarily accepted.

C. M. R. GRAHAM, Mayor,
Chairman Board of Control.
London, Ont., Feb. 23rd, 1914. 8-9



Department of Railways and Canals, Canada

Trent Canal Section 2, Severn Division

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Section No. 2, Severn Division, Trent Canal," will be received at this office until 12 o'clock noon on **Monday, March 23rd, 1914**.

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa; at the office of the Superintending Engineer, Trent Canal, Peterborough, Ont.; and at the office of the District Engineer, Public Works Department, Midland, Ont.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence, of each member of the firm.

An accepted bank cheque on a chartered bank of Canada, for the sum of \$36,000, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderers will be held as security, or part security, for the due fulfillment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,

Asst. Deputy Minister and Secretary.
Department of Railways and Canals,
Ottawa, February 25th, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—56425. 9-10

Tenders Wanted

Tenders will be received by the undersigned up to **March 7th**, for the building of a School at Bancroft. Approximate cost, \$8,000. Plans and specifications may be seen at Bancroft Drug Store.

I. A. EBY,
Secretary Board.
Bancroft, Ont.

9

Canadian Pacific Railway Company

Notice to Contractors

Sealed proposals will be received by the undersigned up to **12 o'clock noon, Wednesday, the 18th day of March, 1914**, for the excavation, masonry, and concrete work in connection with the double-tracking of Humber River bridge, near Lambton, Ont.

Plans and specifications may be seen at the office of the Resident Engineer, Room 605, Union Station.

The lowest or any tender not necessarily accepted.

A. L. HERTZBERG, Div. Engineer,
Room 601 Union Station, Toronto.
Toronto, March 2nd, 1914.

9



Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, March 17th, 1914**, for the construction of the following works:

Sewers

Argyle Street Storm Overflow Sewer Section No. 1, from Shaw Street to Gladstone Ave.
Bathgate Ave., Felstead Ave. to Danforth Ave.
Enderby Road, Swanwick Ave. to G. T. R.
Fairview Ave., Glenholme Drive to Annette St.
Garfield Ave., Clifton Road to east limit Lot 66, Plan 1474.
Glenwood Ave., Fairview Ave. to Runnymede Rd.
Hemlock Ave., southeast outlet of Maughan Cres., to Robbins Ave.
Kingswood Ave., Queen St. to Kingston Road.
Kinsman Ave., Heath St. to Moore Ave.
Lawlor Ave., Kingston Road to Gerrard St.
Lexlie St., Heath St. to Moore Ave.
Lyal Ave., Wayland Ave. to Pickering Ave.
Malvern Ave., Kingston Rd. to Gerrard St.
Montjoy Ave., Lamb Ave. to Ashdale Ave.
Norwood Road, Swanwick Ave. to G. T. R.
Pickering Ave., Kingston Road to Gerrard St.
Rosedale Heights Drive, west limit Lot 87, Plan 1474 to east limit Lot 67, Plan 1474.
Runnymede Road, Annette St. to St. Clair Ave.
Runnymede Road, Bloor St. to Annette St.
Scarborough Road, Kingston Rd. to north end.
Silver Birch Ave., Queen St. to Kingston Rd.
Swanwick Ave., Wayland Ave. to Pickering Ave.
Wilhelm Street, Heath Street to Moore Ave.
Woodside Ave., Fairview Ave. to Runnymede Road.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenders shall submit with their tender, the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City By-law, must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.
Toronto, February 26th, 1914.

9

City of Wetaskiwin, Alberta

Drilling Gas Wells

Sealed tenders will be received by the undersigned up to **Tuesday, March 17th, 1914**, for drilling one or two natural gas wells in the City of Wetaskiwin to a depth of from 1,500 to 2,000 feet. The price per foot for either one or two wells to be given with contractor furnishing all material, fuel and water and otherwise. Further particulars with copy of log of well at present in operation will be furnished upon application.

The lowest or any tender not necessarily accepted.

E. ROBERTS,
Secretary-Treasurer.

8-9



Tenders

Sealed tenders addressed to the Secretary of the Department of the Interior, Ottawa, Ont., and marked "Tenders for Steel Water Pipe, Banff," and "Tenders for Cast Iron Water Pipe, Banff," will be received up to noon, **April 6th, 1914**, for the supply of:—

(a) Thirteen thousand five hundred (13,500) lineal feet of twenty-inch diameter lapwelded steel pipe, and (b) Twelve thousand (12,000) lineal feet of six-inch diameter cast iron pipe for the water system at Banff, Alta.

Specifications may be had from the Commissioner of Dominion Parks, Ottawa, Ont., The Chief Superintendent of Dominion Parks, Edmonton, Alta., The Superintendent, Rocky Mountains Park, Banff, Alta.

The lowest or any tender not necessarily accepted.

The unauthorized insertion of this advertisement in any newspaper will not be paid for.

LYNDWODE PEREIRA,
Secretary.

Department of the Interior,
Ottawa, Ont. —56134. 9-10

CANADIAN PACIFIC RAILWAY COMPANY DEPARTMENT OF NATURAL RESOURCES ENGINEERING BRANCH

TENDERS FOR TIMBER STRUCTURES

Sealed tenders, addressed to the undersigned and endorsed "Tenders for Timber Structures," will be received up to noon of **March 14th, 1914**.

The work to be let includes the timber (Irrigation) structures in about half the area of the Eastern Section of the Company's Irrigation Block in Alberta.

Approximate quantities are 3,550,000 feet B.M. of timber and 18,000 cubic yards of excavation. All construction materials will be furnished by the Railway Company.

Plans, specifications and full information will be furnished on application to the undersigned. A deposit of \$50 will be required before plans, etc., will be given out, which will be refunded on their return in good condition.

All proposals must be accompanied by a certified cheque, payable to the undersigned, for five per cent. (5 p.c.) of the amount of the tender, to be forfeited as liquidated damages should the bidder neglect or refuse to enter into a contract if the work is awarded to him.

All proposals must be made on the standard form provided or they will not be considered. Any alterations thereto, interlineations or qualifying of prices may invalidate the proposal.

The right is reserved to reject any or all bids and to waive defects.

A. S. DAWSON,
Chief Engineer.
Calgary, Alberta. 8-10

TOWN OF HUMBOLDT PROVINCE OF SASKATCHEWAN

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer until 8 p.m., **Wednesday, April 15th**, for the following works:—

Contract "A"—Labor Laying Water Mains and Sewers.
Contract "B"—Pump House and Filter House.
Contract "C"—Furnishing Material for, and Erecting Water Towers.
Contract "D"—Furnishing Cast Iron Water Pipes.
Contract "E"—Furnishing Fire Hydrants and Valves.
Contract "F"—Furnishing and Installing Pressure Filters.
Contract "G"—Furnishing and Installing Pumping Machinery.
Contract "N"—Furnishing wood Stave Pipe.
Contract "O"—Laying Wood Stave Pipe.
Contract "P"—Constructing Ejector Station.
Contract "S"—Furnishing Sewer Pipes.
Contract "X"—Constructing Sewage Disposal Works.

Plans and specifications may be seen at the office of the Engineers, Toronto and Winnipeg, and at the Town Hall, Humboldt, on and after **March 16th**.

No tender necessarily accepted.

W. H. STILES, Esq., Sec.-Treasurer,
O. W. ANDREASEN, Esq., Mayor,
CHIPMAN & POWER, Engineers. 9-11

Board of Education

Time Extended for Receiving Tenders

Owing to the tenders previously submitted being informal and the Board having decided that all tenders shall be formal in every particular,

Sealed tenders, whole or separate, addressed to the Secretary-Treasurer of the Board, will be received until

Friday, 4 p.m., March 13th, 1914

For the completion of

Duke of Connaught School

Carpenter work
Plastering
Painting
Plumbing
(Also Plumbing at other schools)

Harbord St. Collegiate Institute

Mason work
Structural Steel work
Ash Hoist

Furniture

Teachers' desks, tables and chairs

Specifications may be seen and all information obtained at the office of the Superintendent of Buildings, City Hall, Toronto. Each tender must be accompanied with an accepted bank cheque for five per cent. of the amount of tender or its equivalent in cash. Any contractor having tendered and enclosed a deposit will state that deposit accompanied previous tender. Tenders must be in the hands of the Secretary-Treasurer at his office in the City Hall, not later than 4 o'clock on the day named, after which no tender will be received. The lowest or any tender will not necessarily be accepted. All tenders must be on revised forms filled out in every particular according to directions thereon.

W. C. WILKINSON,
Secretary-Treasurer.
J. W. JACKSON,
Chairman of Committee.

9

Residence Tenders

Tenders will be received up to 5 p.m., March 12, for the construction and completion of a brick residence on Helen Street, St. Catharines. Plans and specifications can be obtained from Mr. Jos. Daw, architect, 165 St. Paul Street, St. Catharines, Ont., also on file at Contract Record, Toronto.

School Tenders

Whole or separate tenders will be received by the undersigned, up to and including Monday, March 16th, 1914, for the erection and completion of a Public School Building for the Public School Board of the City of Stratford.

The lowest or any tender not necessarily accepted.

Plans may be seen at the office of the Contract Record.

JAS. S. RUSSELL, Architect,
9-10 Stratford, Ont.

For Sale

Dredge, Tug and Scaws

L. BROOKS,
8-9 455 Ontario St., Toronto

For Sale

One standard gauge locomotive in operating condition. Cylinders 24 in. x 18 in.

The Jenckes Machine Company, Ltd.,
6-19 Sherbrooke, Que.

Draughtsman Wanted

One or two first class architectural draughtsmen required at once. Applicants must state experience also salary expected. Box 963, Contract Record, Toronto.

Street Foreman Wanted

Applications marked "Street Foreman" will be received by the undersigned up to noon on Thursday, March 12th, 1914, for the position of Street Foreman for the City of Guelph. Applicants to give references and state experience and salary expected.

T. J. MOORE,
9 City Clerk.

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent., an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929 Contract Record, Toronto. 53-12

Notice

Applications for the position of General Foreman of Surface Work will be received until Monday, March 16th. The duties of this official will be the direction of the street maintenance department, street grading, macadamizing, sidewalk construction, curb and gutter, and retaining walls.

Applicants should state in detail their previous experience and submit testimonials, also salary required and when they can take up the duties.

Preference will be given to a man familiar with the details of street pavement construction and street railway work. Further information can be obtained from the undersigned, to whom all applications should be addressed.

A. K. GRIMMER,
City Engineer.

City Hall, Medicine Hat,
February 24th, 1914.

9-10

Town Engineer Wanted

TOWN OF MELVILLE SASKATCHEWAN

Applications will be received by the undersigned until six p.m., Monday, March 16th, 1914, for the position of engineer for the Town of Melville. Applicants will please give details of experience in sewage installation and other branches of work, and state salary required.

By order,

FRED. H. CLARKSON,
Town Clerk.

8-9

For Sale

Steam Shovels

1-45-ton Vulcan on R.R. wheels, with 3 sets of engines, 1½ yd. dipper. Excellent condition. Price \$3,000.

1-30-ton Vulcan Little Giant traction, with 3 sets of engines, 1 yd. dipper. Rebuilt. Price \$2,800.

1-25-ton Little Giant full circle on traction wheels, with 3 sets of engines, 5/8th yd. dipper. As good as new. Price \$2,800.

1-No. 0 Thew full circle traction, 5/8th yd. dipper on traction wheels. \$2,700.

Trench Machines

1-Parson steam machine; cuts trench 27-in. to 60-in. wide, 20 ft. deep. Price \$3,500.

1-Buckeye; cuts trench 27-in. to 30-in. wide, 10 ft. deep. Price \$3,000.

1-No. 3 Municipal; cuts trench 24-in. to 48-in. wide, 22 ft. deep. Price \$6,000

Write us for prices on new Cream City trench machines.

Cream City Equipment Company,
400 Majestic Building,

9-12 Milwaukee, Wis.

Residences

(Continued from page 81)

been drawn by W. E. Noffke, Central Chmbrs. Estimated cost \$18,000.

Shanty Bay, Ont.

Plans for a \$12,000 residence have been drawn for J. B. Willison, Barrie, Ont., by J. H. Robertson, Orillia.

St. Catharines, Ont.

Tenders for the erection of a residence, to cost \$6,000, will be received by Joseph Daw, architect, 165 St. Paul St., until March 10th.

Sherbrooke, Que.

Plans for a \$8,000 residence, on Victoria St., for Chas. D. White, have been drawn by H. G. James, architect, 4 Magazine.

Toronto, Ont.

Plans for 3 pair residences, on Elmer Ave., have been drawn for E. & E. M. Knaption, 17 Kenilworth Ave. Estimated cost \$11,000.

Burke & Co., 28 Toronto St., are now open for tenders on 4 attached brick residences, in the Woodbine District.

Plans for 6 detached residences, on Christie St., have been drawn for R. C.

Bustard, 7 Queen St. E. Estimated cost \$21,000.

Plans for one detached residence, on Rowanwood, have been drawn for C. E. Tyler, 5 Cumberland St.

Winnipeg, Man., Home

Th. Hansson & Eliasson, Suite 7, Alverstone Block, are contemplating the erection of an apartment block, at an estimated cost of \$25,000. Architect, A. Sigurdson, 842 Lipton.

Winnipeg, Man.

Tenders for the erection of an apartment block, on Wellington Crescent, for W. D. McBean, 229 Wellington Crescent, will be received by Jordon & Over, Canada Life Bldg., architects, until April 15. Estimated cost \$200,000.

Plans for an apartment block, on Mulvey Ave., for the International Investment Co., 642 Somerset Block, are being drawn by H. Genser, 305 Northern Crown Bank. Estimated cost \$60,000.

CONTRACTS AWARDED

Brockville, Ont.

The contract for a double residence on James Street for Geo. Hutcheson, has been let to Fred Clow.

Hamilton, Ont.

The following sub-contracts on 6 pair residences, on Balsam St., for A. Hines, 21 Barton St. W., have been let. General contractors and carpentry, R. Press & Son, 142 Ferguson St. Mason, C. Kidd, 90 Burris St. Plastering, T. Trenton & Son, 557 Aberdeen. Galvanized iron, Vincent Drew, 261 Cannon E. Painting, W. T. Down, Adams St. Furnace, J. Radigan & Co., 323 King St. E. Electrical, Pottier & Bizley, 273 King E. Sewer, J. J. Armstrong & Sons, 48 Burris street.

Montreal, Que.

The contract for the erection of 12 flats, on 20 Chambly, has been awarded by Owner, J. E. Tremblay, 17 Chambly St., to P. Gauthier, 28 Masse St.

Toronto, Ont.

The following contracts have been awarded on the Valley Crest residence of A. C. Robinson. General contractor, J. T. Dean, 171 Roehampton Ave. Hollow Tile, National Fireproofing Co., Traders Bank Bldg. Sheet metal and roofing, W. C. Gurney, 4 Spruce street. Heating and plumbing, Read Franklin, Ltd., 553 Bloor W. Plastering, Hanna & Nelson, 273 Rusholme Road.

The following contracts have been awarded on the duplex residence, on Oriole Rd., for S. F. Arkush, 380 Queen W. Mason, Teagle & Son, 55 Boswell Ave. Carpentry, A. Clark & Son, 90 Farnham Ave. Plumbing, Purdy, Mansell, Ltd., 63 Albert St. Plastering, R. C. Dancy, 153 Spadina Rd. Contracts on the other trades are not yet awarded.

The following contracts on the residence, on Oriole Rd., for P. W. Ellis, 31 Wellington St. E., have been awarded. Mason, Wood & Son, 613 Manning Ave. Carpentry, Cox & Cummings, Canada Life Bldg. Plastering, Wallace Haney, 197 Degraess St. Roofing, A. Matthews, Ltd., 256 Adelaide W. The tenders for plumbing are in, but contract is not yet awarded.

“Inglis” Corliss Engines

are known above all others as being pre-eminently “Engines of Quality,” Economical, Durable and Reliable and can be depended upon to give the same good results twenty years from now.

We build them Single, Tandem, Compound and Triple, for heavy or light duty. Remember our Fifty year reputation is back of every “INGLIS” engine. Specifications and prices upon request.

The John Inglis Company

ENGINEERS AND BOILERMAKERS

Limited

14 Strachan Ave.,

Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

Power Plants, Electricity and Telephones

Calgary, Alta.

Tenders will be received by the City Commrs. until noon March 18, for manufacture, delivery and placing in satisfactory operation of two 12,000 volt, 3,000 kw. step-down transformers. Information at the office of Electrician, R. A. Brown.

Preston, Ont.

The alterations and extension to the electric lighting system have been completed. Clerk, H. C. Edgar.

Regina, Sask.

The ratepayers will vote on by-law March 11, for extension to electric lighting and power system, by installation of a motor converter and necessary equipment. The amount involved is \$160,000.

Toronto, Ont.

Toronto Hydro-electric System, 226 Yonge St., will receive tenders until March 12th, for the supply of transformers. Specifications, etc., from the Purchasing Agent.

Waubushene, Ont.

The electric lighting by-law having been carried, poles, etc., may be required. Further information can be obtained from Chas. Stocking, chairman of the Electric Light Commission.

Woodstock, Ont.

Tenders will be received by N. E. Birtch, Clerk to the Oxford County Council, until March 10th, for electric wiring at the county gaol, the registry office, and the Turnkey's & Gaoler's residences. Plans and specifications at the office of the county clerk.

CONTRACTS AWARDED

Calgary, Alta.

The city council has awarded the following contracts. Canadian General Electric Co., 11th Ave. and 4th St. W., 1/3 of 5 ampere all of 25, 40, 50, 75, 120, 150, 200 and 300 ampere single-phase, 110 volts, 2-wire meters. All 25, 50, 75, 100 and 300 ampere 110-220 volt 3-wire meters, all 75, 100, 150, 200 and 300 ampere, 200 volt poly-phase meters. Canadian Maloney Elec. Co., Ltd., 901 Elec. Rly. Chmbrs., Winnipeg, Man., 1/3 of 5 ampere all the 10, 20, 30 ampere single-phase, 110 volt, 2-wire and 20 ampere, 3-wire meters. Packard Elec. Co., Ltd., Rm. 402 Donald Bldg., Winnipeg, 1/3, 5 ampere single-phase 110 volts, 2-wire meters all 5, 10, 30, 40, 60, 80 and 100 ampere 3-wire, 110-220 volt meters, all of 5, 10, 15, 20, 30, 40, 50 and 60 ampere, 200 volt poly-phase meters.

Ottawa, Ont.

The contract for installation of motors at the Lowe-Martin Printing Co., Slater St., has been awarded to B. H. Baldwin, 52 Queen St.

The contract for heating and plumbing at the residence erected on Centre St., by Adamson & Robertson, has been awarded to Holloway & Son, 373 Somerset Street.

Trenton, Ont.

The contract for electric wiring in the public building has been awarded by the Public Works Department, to The Geo. E. B. Grinyer Co., Ltd., Guelph, Ont.

Winnipeg, Man.

The Board of Control has awarded a contract to J. Macdonald & Wm. Newman & Co., for towers on the new transmission line, at \$52,169.20.

The Board of Control has awarded contracts as follows:—Canadian Westinghouse Co., Ltd., Portage Ave., for single-phase pole type transformers; Chapman & Walker, 118 Richmond St. W., Toronto, for three-phase pole type transformers; Canadian Moloney Elec. Co., Ltd., Mercer & Essex Terminal, Windsor, Ont., for single-phase and 3-phase subway transformers.

Miscellaneous

Berlin, Ont.

The Berlin Light Commsn., King St. W., will receive tenders for a gas retort, capacity 350,000 cu. ft., 2 lift telescopic design, outer lift 102 ft. diam. x 22 ft. deep, inner lift 100 ft. x 22 ft. deep. Rivetted steel tank. Specification at office of Commission, Consulting Engineer, John Keillor, Hamilton Gas Plant.

The Berlin Light Commsn., King St. W., are about to purchase 60 30 ft. and 40 20 ft. poles for wiring purposes.

Calgary, Alta.

A. S. Dawson, chief engineer of the C. P. R., invites tenders until noon March 14th, for the construction of timber(irrigation) structures in about half the area of the Eastern Section of the company's irrigation block in Alberta. Approximate quantities: 3,550,000 ft. B.M. of timber and 18,000 cu. yds. excavation. All construction materials to be furnished by railway company.

Hamilton, Ont.

The Canadian Fox Chain Co. will rent a factory instead of building at present, and will require machinery for manufacture of chains.

London, Ont.

The Utilities Commsn., Chairman, Philip Pocock, are considering the purchase of 100,000 red pressed bricks, 50 tons structural steel, window frames and stairs.

Montreal, Que., St. Lambert

Tenders will be called by Engineer, Drinkwater, about the end of March, for pipe fittings, valves, hydrants, vitrified drain pipes and electric lighting standards.

Ottawa, Ont.

Fire Chief Graham recommends the purchase of motor tractor, four 30-gallon chemical tanks for hose wagon, also rubber tires for hook and ladder trucks, and rapid hoisting device for aerial-truck.

Tillsonburg, Ont.

West & Jackson, Rolph St., are enquiring in regard to lumber for flooring and woodwork for new library building. Details of materials required will be furnished on application.

Wainwright, Alta.

Tenders will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, for 3,000 concrete posts, to replace for present ones. If satisfactory, 25,000 will be required next year.

CONTRACTS AWARDED

Assiniboia, Man.

The Rural Municipality of Assiniboia has awarded the following contracts for

the supply of lumber. Francis & Francis, Headingly, Man., for Wards 1 and 2. The John Arbuthnot Lumber Co., Ltd., Logan & Princess Ave., Winnipeg, for Wards, 3, 4, 5 and 6.

Business Notes

Bow Island, Alta.

A serious fire occurred here and the following suffered loss. Bow Island Trading Co., store; F. Sutton, pool room and barber shop; Bow Island Brick & Tile Co., offices; E. C. Ludtke & B. L. Jamieson (Real Estate); B. T. Whitney, Prop., Mrs. Cochrane, restaurant; E. C. Ludtke, Prop., W. E. Mathers, bake shop. Total loss, \$34,000 to building and stock, covered by about \$14,000 insurance.

Petrolia, Ont.

The factory of the Petrolia Motor Co., with 40 motors and trucks has been destroyed by fire.

Sherbrooke, Que.

The tenement house, on Wellington St., owned by A. C. Skinner & H. V. Haight, has been destroyed by fire. A complete new business block building will be erected on site in the spring. Plans will be prepared later.

St. John, N.B.

The Grand Union Hotel, a brick building, owned by Jno. Sime, Water St., has been destroyed by fire to the extent of \$8,000; the loss is covered by insurance.

St. Hyacinthe, Que.

The St. Hyacinthe academy has been totally destroyed by fire. Loss \$30,000; covered by insurance.

Toronto, Ont.

Lansdowne school was badly gutted by fire. Estimated loss \$25,000; the seating and manual training apparatus were destroyed.

Windsor, Ont.

The grocery store and bakery of A. L. Thibodeau, 117 London St. W., has been damaged by fire. Loss, \$5,000.

New Companies

The Gloucester Concrete Co., Ltd., has been incorporated with a capital of \$25,000, with head office at Bathurst, N.B., to carry on business as concrete manufacturers. The provisional directors are J. B. Hachey, J. Robertson, W. C. White and A. J. H. Stewart, all of Bathurst, N.B.

Hafer Machine Company, Limited, has been incorporated with a capital of \$15,000, with head office at Victoria, B.C., to carry on business as ironfounders and mechanical engineers.

La Compagnie Industrielle de Joliette Limitee, has been incorporated with a capital of \$12,000, with head office at Joliette, Que., to carry on business as lumber merchants, etc. The provisional directors are Z. Bacon, C. Ladouceur, N. Boucher, manufacturers, and L. Trudel, joiner, all of Joliette, Que.

La Compagnie Electrique Des-Rivieres has been incorporated with a capital of \$40,000, with head office at Notre-Dame de Stanbridge, Que., to carry on business as a general power company. The provisional directors are A. Fournier, H. Renaud and A. Bombardier of Notre-Dame de Stanbridge, Que.



CONTRACTORS' EQUIPMENT

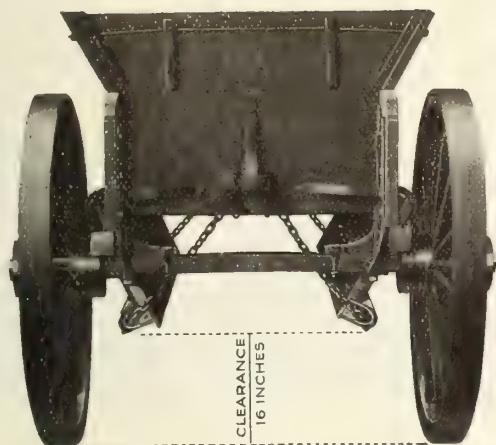
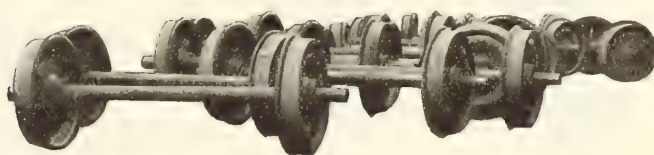
Steam Hoists, Electric Hoists, Horse Powers, Belt Hoists, Hand Winches, Derricks, Car Wheels, Axles and Boxes, Dump Cars, Rail Cars, Buckets, etc.

Do not wait for the **Spring** rush, order **now** and have your plant ready for an early start.

Marsh & Henthorn, Limited - Belleville, Ont.

Makers of Hoisting Machinery

Sales Agents—
Mussens, Limited,
Montreal, Que.



CLEARANCE
16 INCHES

The Last Ten Dollars

in a dumping wagon is the best part of its price. It may mark the difference between the commonplace and the excellent.

Watsons cost you more. They are not sold on price. And yet thousands more buy the Watson every year. Nobody will give you something for nothing. We don't claim to. Why not get the Watson catalog?

John Deere Plow Co. of Welland, Ltd.
77-79 Jarvis St., Toronto, Ont.

Buy the Brick of Proven Merit

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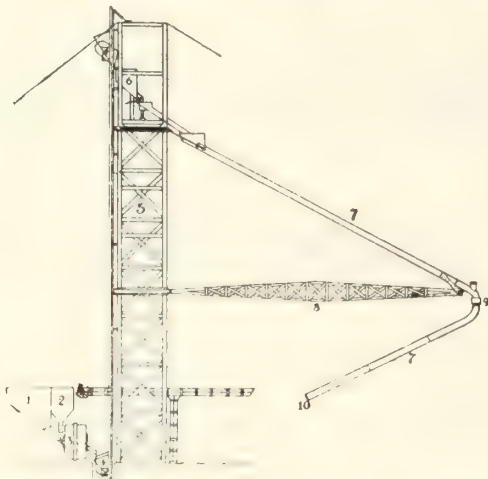
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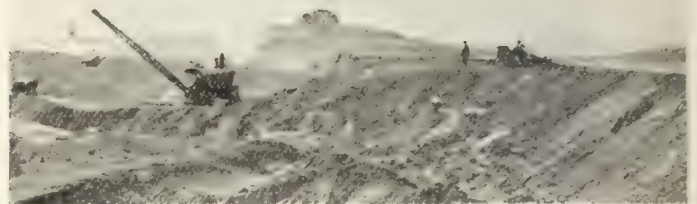
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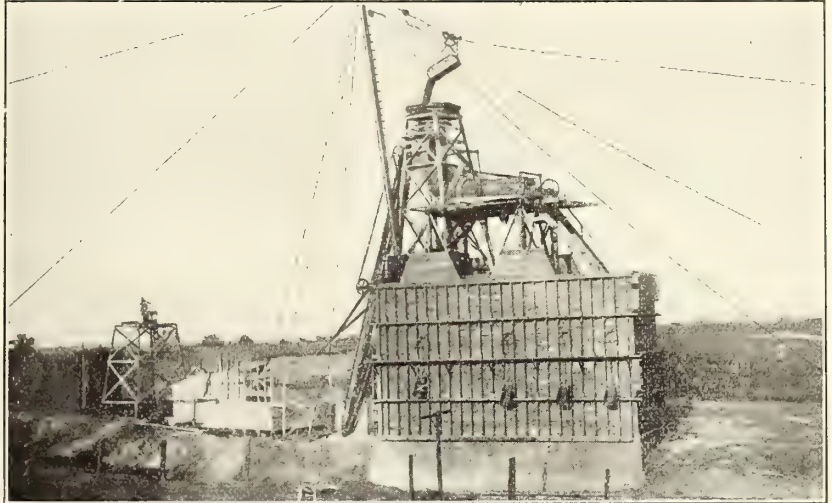
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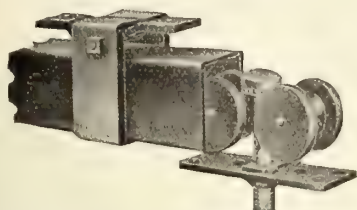
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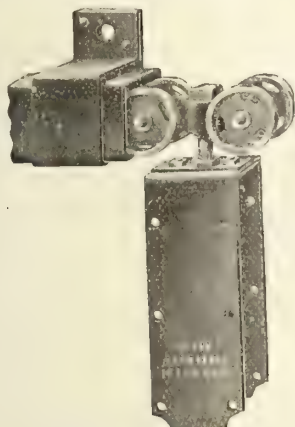
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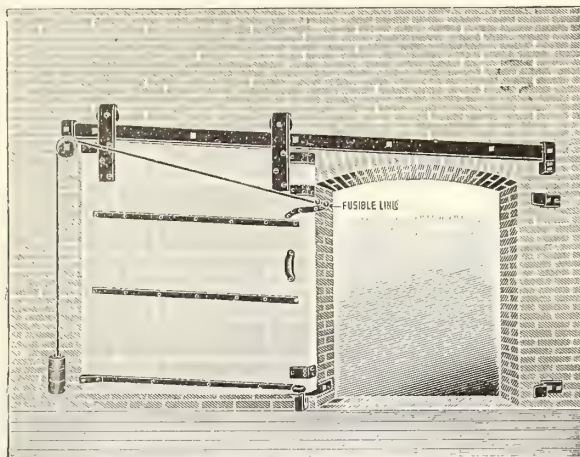
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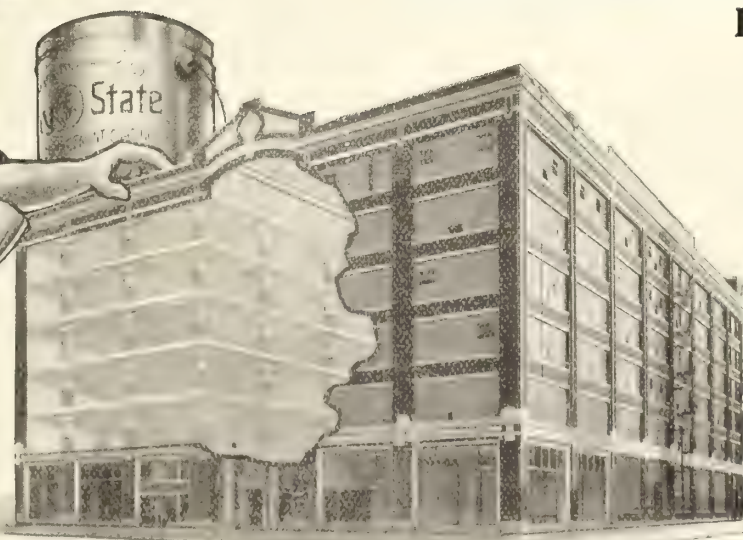
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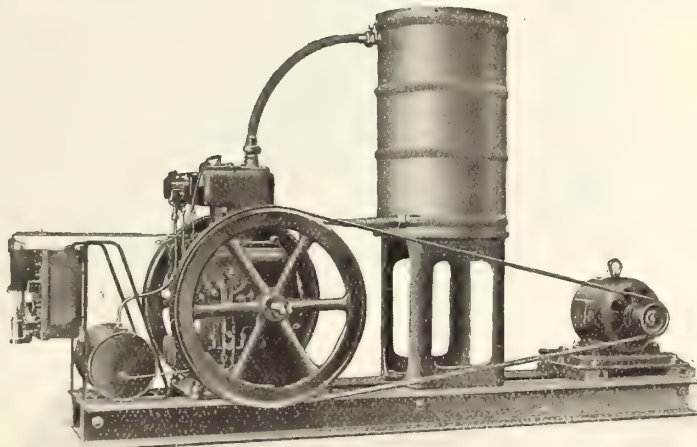
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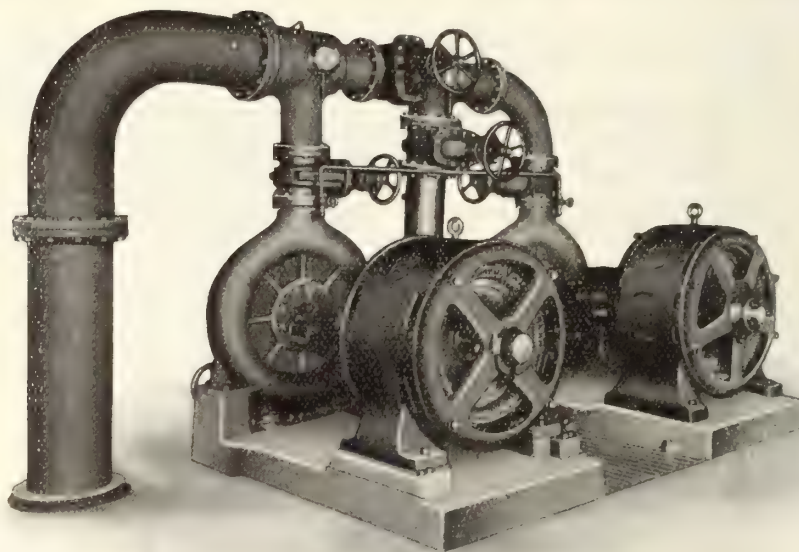
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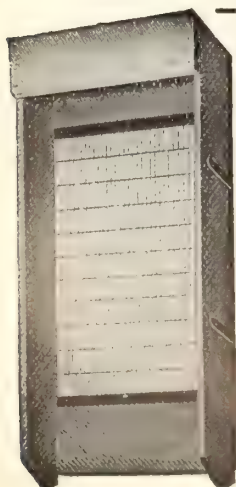
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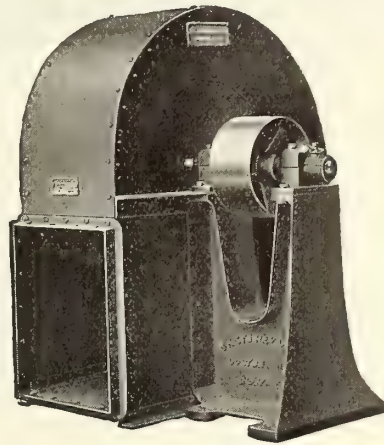
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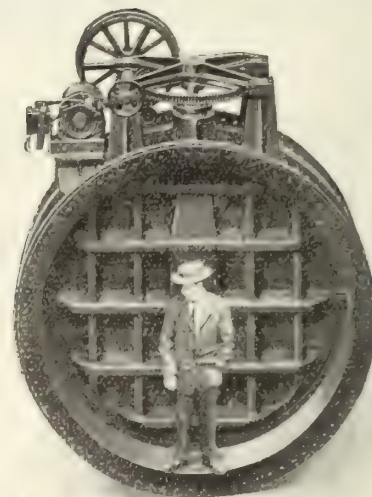
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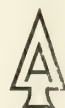
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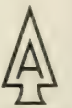
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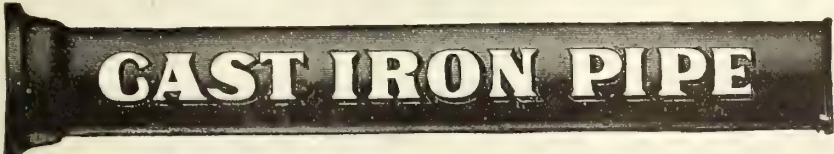
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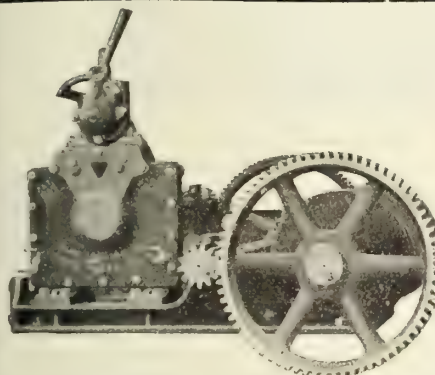
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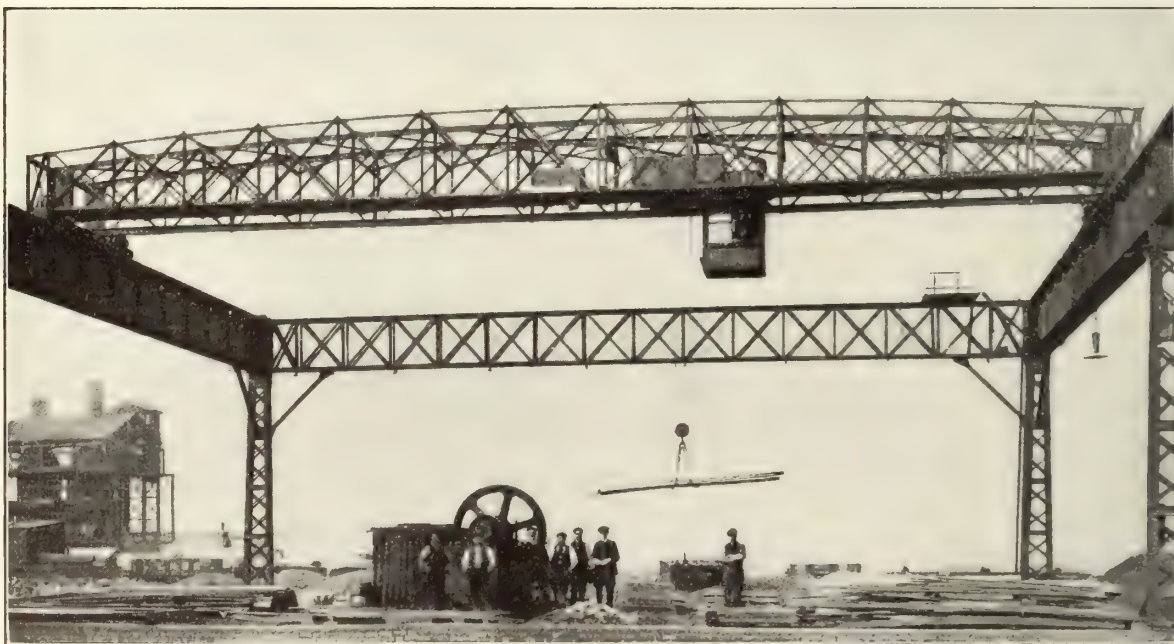


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**Galvanized Wire Wound and Continuous Stave Pipe
for Water Works, Power, Irrigation, etc.**

Withstands 250 lb. working pressure.



Not affected by Frost,
Corrosion, Electricity or
Acid. Water Works Sys-
tems installed. Prompt
attention to inquiries.

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Factory: 550 Pacific St., VANCOUVER, B. C.

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The new plant of the Northern Aluminum Company, Toronto. The contract for roofing and sheet metal was executed by us.

We specialize in

**The Built up Pitch, Felt and Gravel Roofing, Damp-proofing
Foundations, Slating, etc.**

We also manufacture

**SKYLIGHTS, CORNICE, FIRE DOORS AND WINDOWS, TIN CLAD DOORS, ASPHALTS,
TARRED AND DRY FELTS, COAL TAR PITCH**

We will quote you attractive prices on any of the above—write us.

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Roofing and Sheet Metal Contractors

530 Front Street West

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Pulp and Paper Mills
Chemical Works
Oil Refineries, Etc.

We also build

Steel Structures
to support them.

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SHERBROOKE, QUE.

Municipal Filtration and Water Softening Plants

Designed,
Installed and
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We GUARANTEE
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Conditions

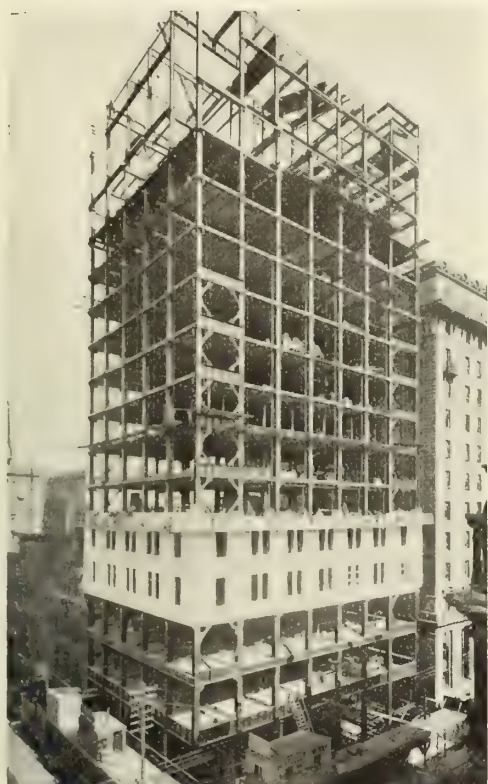
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 Structural Steel Painted with
 "SUPERIOR GRAPHITE PAINT"

The Structural Steel of
The Highest Commercial Building
 in the British Empire
 is protected by
**"SUPERIOR GRAPHITE
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The use of this Paint absolutely insures steel
 against damage by Rust or Electrolysis.

SPECIFIED BY LEADING ARCHITECTS

Because it has Twenty-five years of **proven** service
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Made only by

DOMINION PAINT WORKS, LIMITED
 Montreal Toronto WALKERVILLE, ONT. Winnipeg
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Made in U.S.A. by DETROIT GRAPHITE CO., Detroit, Mich.

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We would be pleased to submit prices on
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Tugs Dredges Scows
Wharves Coal Shoots or Piling

It would be entirely to your advantage to have competitive prices on your
 requirements, and to have our prices even if only as a matter of record.

OUR MILLS RUN ALL WINTER.

JAMES SHEPPARD & SON
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SIX REASONS

which account for the superiority of

Creosoted Wood Block Pavements

Its Durability; Does not crumble or pulverize under the densest traffic; second only to granite blocks.

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We manufacture blocks of the highest possible standard, the very best materials only being used and in the DOMINION WOOD BLOCKS we believe we produce an article that has no equal.

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THE NORTHWESTERN TERRA COTTA COMPANY



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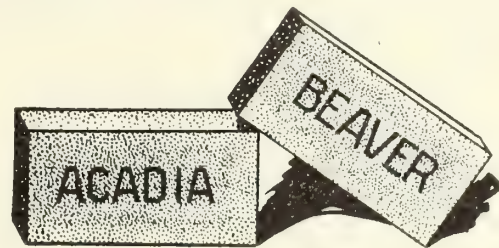
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General Steel Contractors
Large stock I Beams, Channels, Angles, Tees, Zees, and Plates always on hand.

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STONE of any Size and in any Quantity on hand for
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Uniform Pressed Brick

Many pressed bricks of merit fail to "make good" because they are not uniform in size, or quality, or shade.

In the burning of Acadia and Beaver pressed bricks we have succeeded in producing a brick absolutely uniform in size, in color and in quality.

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Prompt shipment on every order.

Nova Scotia Clay Works, Ltd.
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WINDOW
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GLASS
BENDERS
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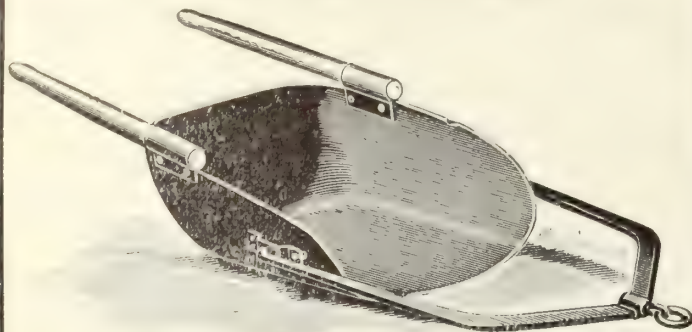
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Plate, Window, Figured, Stained, Wired, Bent, Mirror
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The Best Value for Your Money



IN CONTRACTORS' SUPPLIES

Our DRAG SCRAPERs have pressed bowls of high carbon steel—all joints and seams being eliminated. They are stiff and serviceable. WHEEL SCRAPERs can be supplied with either square pan or pressed bowl and have the latest and most approved dumping attachments.

Always order by the name—

IRON AGE

Our STEEL TRAY BARROWS with trays pressed from solid sheets of high carbon steel, without seams or joints, are the standard with all the leading contractors.

Remember we make Pick and Rooter Ploughs to satisfy the most exacting conditions. Catalogue will be sent free on request.

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Portland Cement

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Keenes Cement

Plaster Paris

Hard Wall Plaster

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Fire Brick

Sewer Pipe

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With our 9 Branch yards situated as they are we are prepared to guarantee a prompt delivery service of any orders you may favor us with and would ask you to give us a trial in order that we might prove same to you and also prove the excellence of our material.

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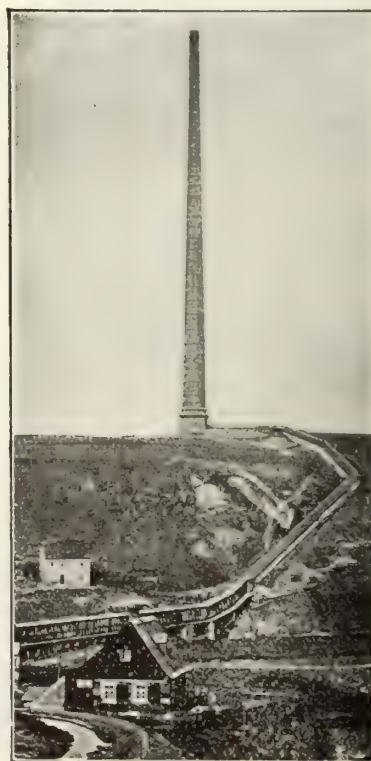
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Also Agents for MASTIC ASPHALT for Sidewalks.

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460 feet x 8 feet 2 in.

World's Largest Chimney

Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

HEINICKE CHIMNEYS

will be found proving their superiority to over 4,000 users in every part of the country. The day of common brick and metal stacks is gone—if you are building a chimney make it a HEINICKE.

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Sand, Gravel and Crushed Stone

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*Our prices are right and our service good.***Britnell & Co., Limited**

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Phones, Office North { 664 665 } Evenings, North 2107

VANCOUVER WOOD PIPE & TANK CO., LTD.

(Formerly Municipal Construction Co., Ltd.)

Contractors for Waterworks Construction,
Manufacturers of Wire-Wound Wood Pipe, Continuous Stave
Pipe, Tanks, Silos, Steam Casing.

See our new patented Wood Pipe Coupling—Positively LEAK PROOF.

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For rates and other particulars, write

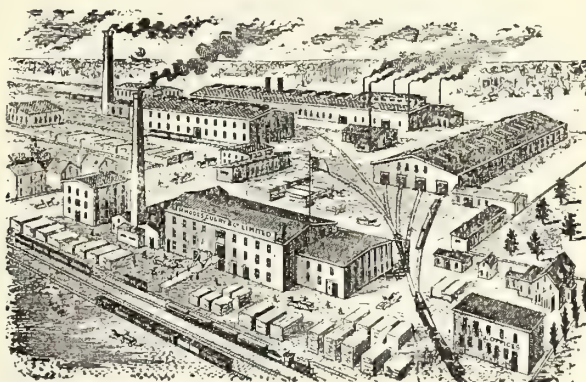
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**Bank and Office Fittings**

SCHOOL DESKS A SPECIALTY

We manufacture all kinds of building materials, including cast iron columns, cresting, sash weights, etc.

In addition to our large stock of native lumber, we are now carrying about one million feet of foreign lumber, including oak, walnut, ebony, whitewood, basswood, red cedar, Douglas fir, mahogany, &c.

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KAHN SYSTEM

OF REINFORCED CONCRETE

Steel Sash

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Pressed Brick for front work and fireplaces.**CRUSHED STONE**—Dimension and Coursing Stone, Lime
FIRE BRICK **IVORY CEMENT PLASTER**

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of all designs in both iron and steel; Roofs, Telephone Poles, House Girders and all kinds of Structural Iron Work.

Our stock in hand comprises Steel Beams, Angles, Tees, Channels, Plates, Rolled Edged Flats, Bars, Rivets, Rounds, &c.; Iron Beams, Bars, Squares, Turnbuckles, Rivets, &c.

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Steel Buildings Roof Trusses

Railway and Highway Bridges

Locomotive Turn Tables and Structural Steel and Iron Work of all descriptions.

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Limited

Toronto, Canada



OUR NEW OFFICE AND WORKS: NORTH SHAW STREET

Main Structural Shop: 130 ft. x 400 ft.

Area of Grounds: Ten Acres

Capacity: 18,000 Tons Annually

We build and erect all kinds of Structural Steel Work
Roof Trusses, Bank and Office Railings, Stair
Work, Elevator Grilles, Fire Escapes, etc.

Over 5,000 Tons in Stock of

Beams, Column Sections, Angles, Tees, Plates, Bars,
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Structural Steel Work of Every Description

Fabricated and Erected by

Toronto Structural Steel Company, Limited

Annual Capacity—20,000 Tons.

Ask for list of material on hand for immediate delivery.

Sales Offices—Atlantic Ave., TORONTO

Works at—Toronto, Ont., Weston, Ont.

STRUCTURAL STEEL FOR QUICK DELIVERY

We carry in stock at Montreal, 8,000 tons of Structural Shapes and are in a position to make quick shipment of either plain or riveted material for

Bridges, Roof Trusses, Columns, Girders, Beams, Towers and Tanks, Penstock.

Estimates furnished promptly. Capacity 18,000 Tons Annually.

Structural Steel Co., Ltd.
Main Office and Works, Montreal

STEEL WORK WHEN YOU WANT IT

STANDARD STEEL CONSTRUCTION CO. Limited

WELLAND - CANADA

MANUFACTURERS AND ERECTORS

Girders, Columns, Trusses, Etc.

STEEL BUILDINGS AND BRIDGES

Bars, Angles, Plates, Beams, Channels
always in stock for immediate shipment.



Elevated Steel Tanks

Hemispherical and Segmental Bottoms

MANUFACTURED AT PITTSBURGH, Pa.
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We have special designs for Municipal, Railway and Industrial service. Catalog No. 15 sent upon request.

Pittsburgh-Des Moines Steel Co.

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Sanitary and Impervious

Adaptable for all kinds of building where the highest standard of brick perfection is demanded.

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CANADA

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Railway and Highway Bridges
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Beams, Channels, Angles, Plates
etc., in stock

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INSPECTED AND LABELLED UNDER THE DIRECTION OF THE UNDERWRITERS LABORATORIES (INC.)
SHEET METAL WORKERS, SKYLIGHTS, CORNICES AND WINDOWS.
LET US ESTIMATE ON YOUR NEXT REQUIREMENTS.

ALL OUR DOORS AND HARDWARE ARE LABELLED BY THE UNDERWRITERS.

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Too much care cannot be taken to have Fire Escapes properly designed and erected. All our work in this line is done in accordance with Government Standard Specifications. Cheerfully we will take measurements and submit estimates and blue prints of the Escape best suited to your requirements.

Interesting literature regarding Escapes sent on request.

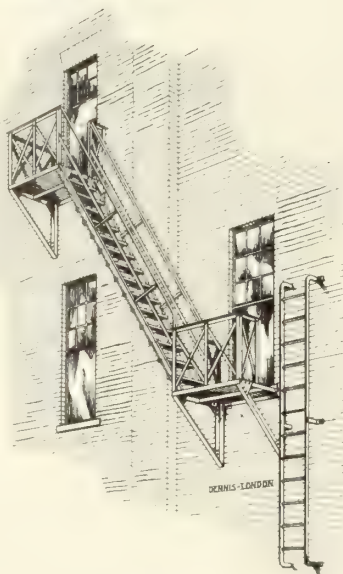
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Dennis Wire & Iron Works Co.

London, Ont.

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McKinnon Electric-Welded Chain



has a 25% factor of safety over the same size of any other make. A swell of 25% added material at the weld makes that point the strongest part of the link.



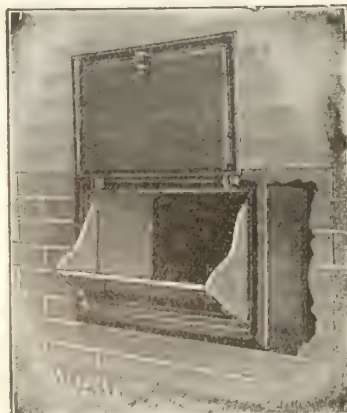
Guaranteed to pull stiff before breaking and not to break at weld.

Sizes 3/16" to 3/4" inclusive.

Made in Canada by

McKinnon Chain Company

St. Catharines, Ont.



EQUIP YOUR CELLAR

with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

The Galt Stove & Furnace Co., Limited, GALT, ONT., CAN.

Toronto Representatives: Black Building Supply Co., Mail Building
Montreal Representative: E. F. Dartnell, No. 8 Beaver Hall Square
Gorman, Clancey & Grindley, Agents, Calgary and Edmonton, Alberta

SAND AND LIME BRICK

IF only because of the great saving in freedom from bats and culls and breakage in handling, our brick would appeal to every wideawake builder.

Add to this absolute uniformity in size and color, great crushing strength and low absorption qualities, prompt delivery in A1 condition and you need look no further for the reason of their popularity with those who have used them.

Look for the YSB stock mark.

York Sandstone Brick Co.
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Architects, Owners and Contractors prefer a uniform plaster guaranteed by the maker.

Anchor Hardwall Plaster

Is made to precise formulae by weight and mixed by machinery. No guess work. No unreliable labor. It sets quickly and hard, works easily and covers large area. No frost troubles. No cracking.

Put up in bags ready for immediate use by mixing with water only.

Write or call for prices and booklet.

Alabastine Hardmortar, Ltd.

Works 136 Esplanade East, Toronto
EAST TORONTO

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Screened Sand and Gravel

**Prompt
Shipment**

York Sand and Gravel Co.
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FOR QUOTATIONS ON

Lime, Stone, Cement,
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**OWEN SOUND
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Deliveries—G.T.R. and C.P.R.

HEAD OFFICE, **1327 Bloor St. West**

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Branch Yards, 53 Merton St.

Phone, North 4751

G.T.R. Belt Line

Night and Sunday calls, Phone Junction, 3333.

Current Prices of Building and Engineering Materials

BRICKS

The following are wholesale prices delivered at Toronto:

	Per M.
No. 1 dry pressed red brick	\$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Brick	13 00
Grey Stock Brick	12 00
Wire cut brick for foundation work	11 00
Porous terra cotta brick	15 00
No. 1 enameled brick, all colors, from	
.....	\$80 00 to \$150 00
Sand-Lime Brick (King Edward Siding).	8 10

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	\$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00

Pine—

1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
3/4 x 8 and 10 in. pine shelving	36 00	42 00
3/4 x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8 in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22	
22x22	38 50
12x22	39 00
10x22	39 50

8x22, 14x24, 18x24, 20x24, 22x24,

24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 20 per cent. for Star and 20 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$ 6 25
26 to 40	4 60	6 75
41 to 50	5 10	7 50
51 to 60	5 35	8 50
61 to 70	5 75	9 75
71 to 80	6 25	11 00
81 to 90	7 00	12 50
91 to 95		17 50
96 to 100		20 50
101 to 105		24 00
106 to 110		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	\$3 50	\$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	\$3 50	\$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS'

SUPPLIES

Standard compression work, 65 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 70 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net\$1.85
No. 4 1/2 Fuller's net\$2.35
Square head brass cocks, 65 and 5 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6 3/4 cents per lb.; traps and bends, 40 per cent.; pig lead, 6 3/4 cents per lb.

Size (per 100 ft.)	Iron Pipe	Galvanized
1/4 inch	\$2.16	1/4 inch \$3.06
3/8 "	2.16	3/8 " 3.06
1/2 "	2.64	1/2 " 3.57
3/4 "	3.05	3/4 " 4.20
1 "	4.51	1 " 6.21
1 1/4 "	6.10	1 1/4 " 8.40
1 1/2 "	7.29	1 1/2 " 10.04
2 "	9.81	2 " 13.51
2 1/2 "	16.80	2 1/2 " 21.65
3 "	20.66	3 " 28.31

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67 1/2; nipples, 4-inch diameter and under, 75 and 10; nipples, 4 1/2-inch and up, 70 and 10; malleable lipped unions, 67 1/2 per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 and 10 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in. 25c ft.	15-in. 1.40 ft.
6-in. 40c ft.	18-in. 1.90 ft.
9-in. 70c ft.	20-in. 2.25 ft.
12-in. 1.00 ft.	24-in. 3.25 ft.

all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.

Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.

Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; 3/4-inch, \$1.45.

Burnt River rubble stone delivered, \$16 to \$17 per toise.

Plain steel bars, \$2.25.

Square twisted bars, 3/4 to 1 1/4, \$2.35.

Malleable fittings—Canadian discount, 45 and 42 1/2 per cent.

Free stone delivered, \$15 to \$18 per toise.

Brown coursing stone, delivered, \$3.75 per yard.

Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.

Sand, for cement or brick work, \$1.20 a cubic yard, f.o.b. Toronto, C. P. R. siding.

Sand, for cement or brick work, 85c to \$1.00 a cubic yard, f.o.b. Toronto, G. T. R. sidings.

Brown sills and heads, in the rough, delivered, 40 cents per foot.

Rubble stone in car lots, \$1.30 per ton.

Steel channels and beams, angles and plates, \$2.55 to \$2.90 per 100 pounds, delivered f.o.b. Toronto.

Hard Wall Plaster, unsanded from \$8.00 to \$8.50, bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.

Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.

Plaster of Paris, Anchor and Crown Brands, \$1.50 bbl.

Manilla Rope, best, per pound, 12 1/2 cents.

PAINTS AND OILS

Pure White Lead, ground in oil, \$8.75 per 100 lbs. Boiled Linseed Oil in bbls., 65c per gal. of 9 lbs.

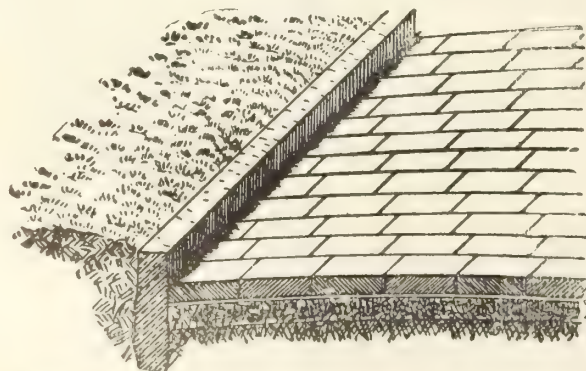
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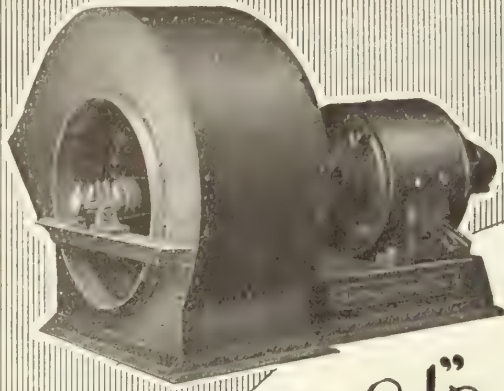
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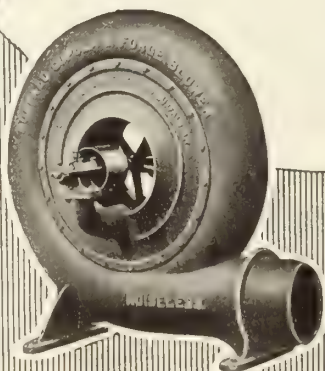
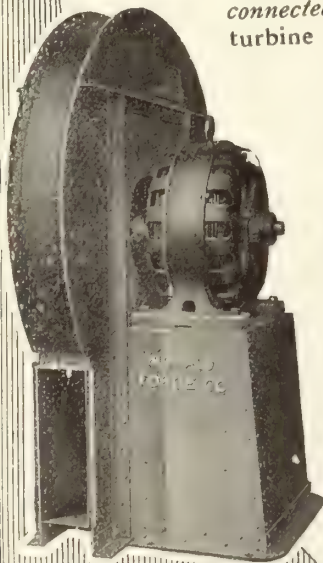
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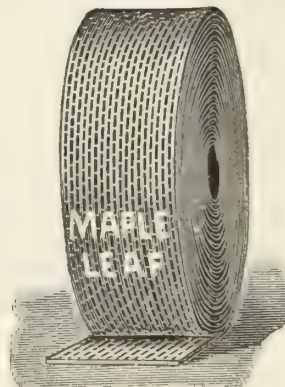
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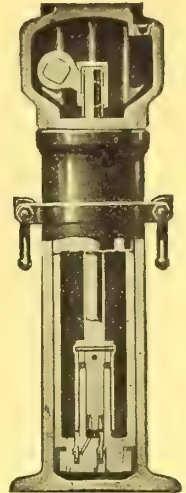
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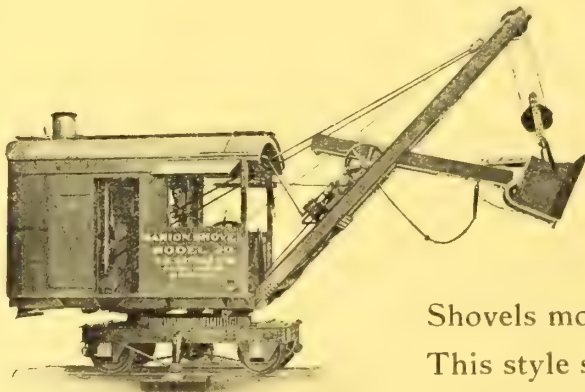
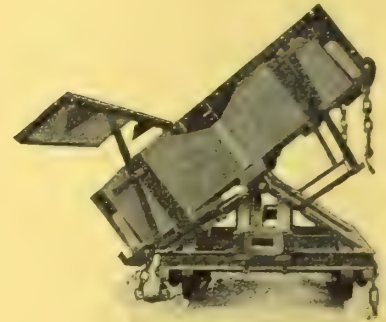
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We will be pleased to submit full particulars.

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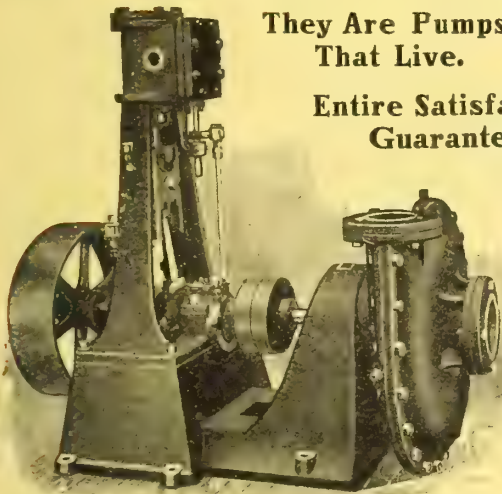
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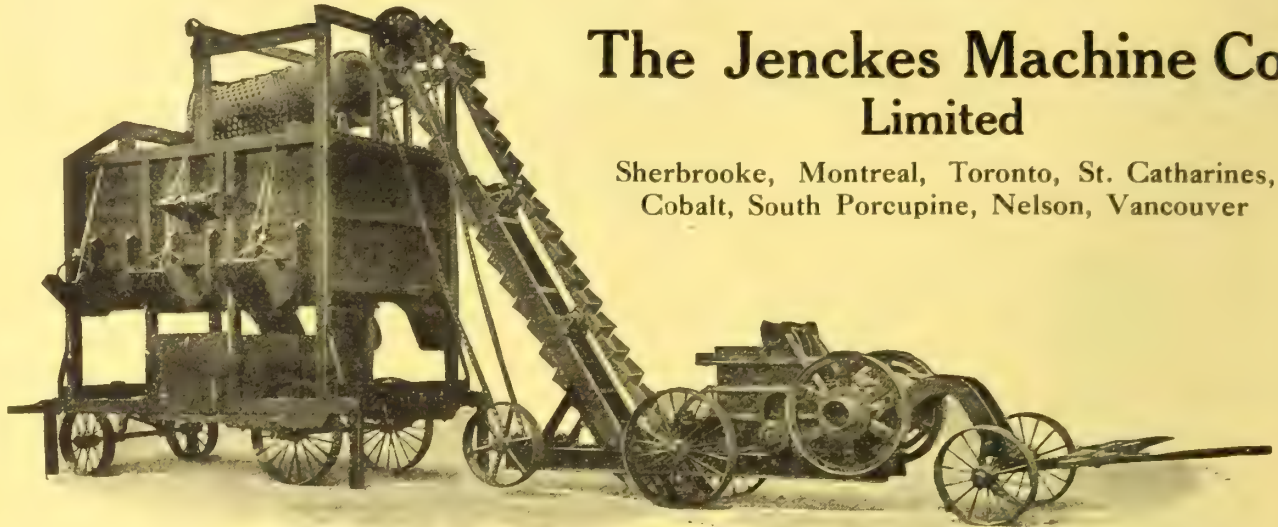
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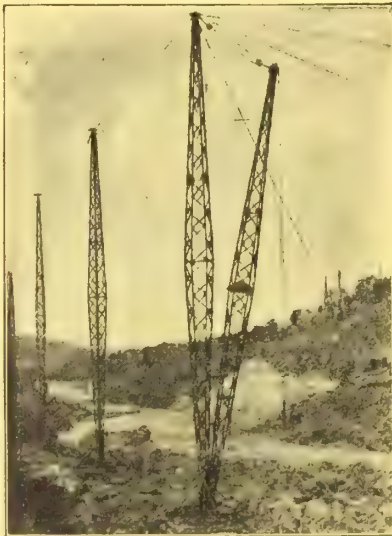
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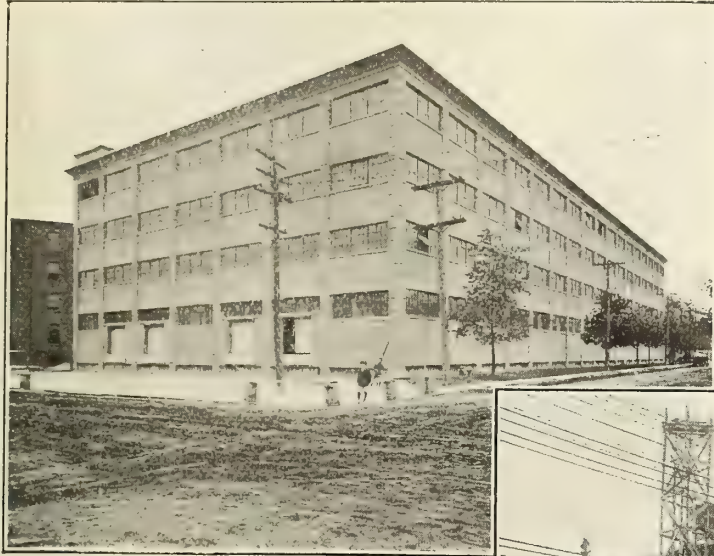
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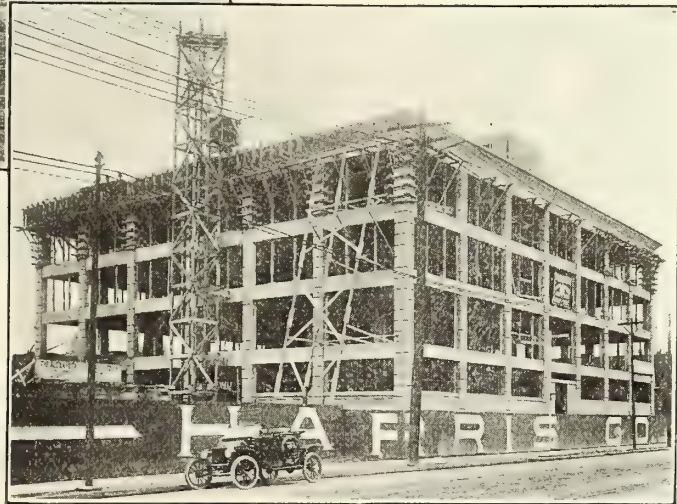
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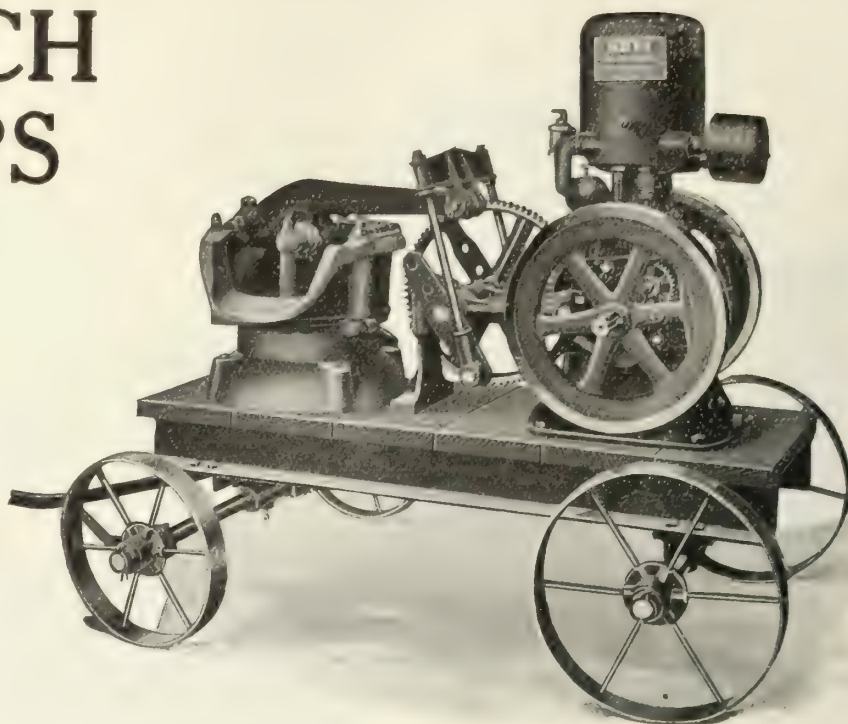
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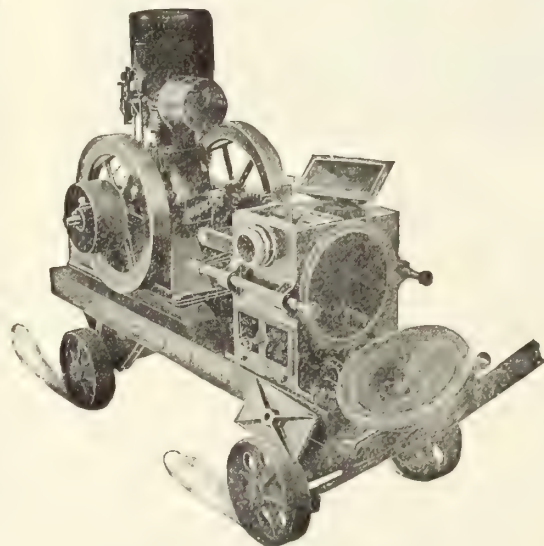
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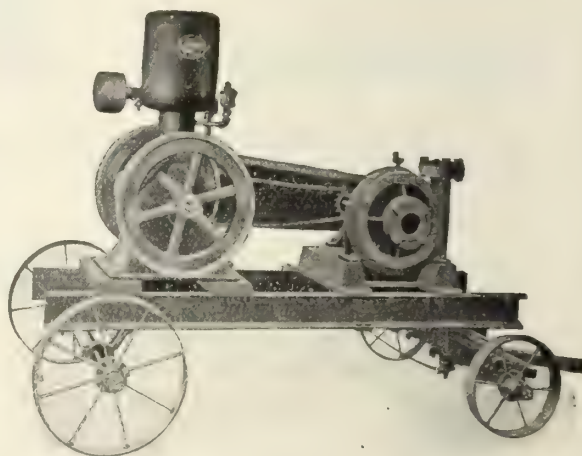


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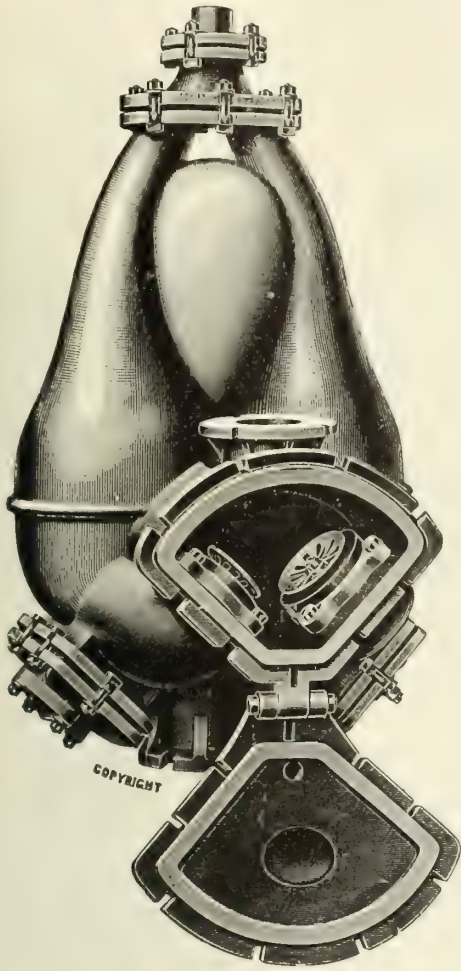
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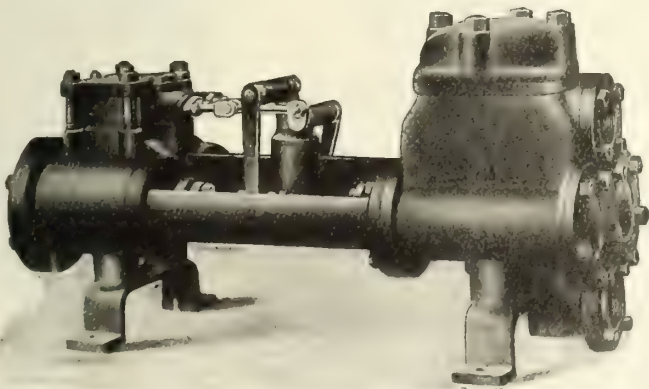
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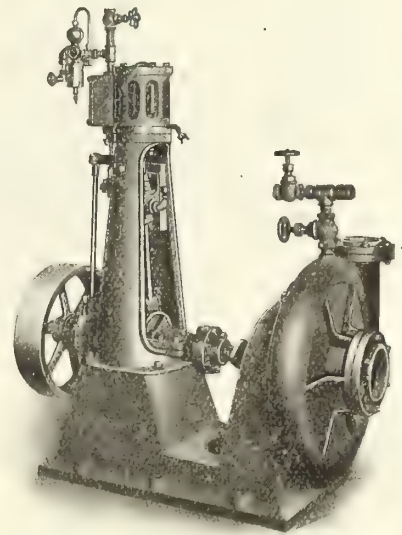


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Heppburn & Co., J. T.
Honig & Mock.
Hopkins & Co., F. H.
Jaeger Machine Company.
Koehring Machine Co.
Lecky & Collis
Marsh & Henthorn
McKinnon Chain Co.
Meaford Wheelbarrow Co.
Morris Machine Works.
Municipal Engineering & Contracting Co.
Montreal Locomotive Works
Mussens Limited
Royce Limited
Sauerman Bros.
Schell Foundry & Machine Co.
Stinson-Reeb Builders' Supply Co.
Wettlaufer Bros.

Conveying Machinery

Dull Co., Raymond W.
Weller Mfg. Company

Core Drills

Can. Ingersoll-Rand Co., Ltd.

Cork Installation Machinery

Linde British Refrigeration Co.

Corrugated Iron

Can. H. W. Johns-Manville Co.
Metallic Roofing Co.
Ormsby, A. B., Limited
Pedlar People Limited.

Cranes, Travelling and Locomotive

American Hoist & Derrick Co.
W. D. Beath & Son
Browning Company.
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.
Northern Crane Works.
Rock & Power Machinery, Ltd.
Roelofson Elevator Works.
Royce Limited

Creosote Stains

Cabot, Inc., Samuel

Crushed Stone and Granite

Hagersville Contracting Co.
Ontario Lime Co., Ltd.
Rogers Supply Company
Smyth & Ryan

Crushers (Stone and Rock)

Canadian Allis-Chalmers, Ltd.
Hamilton Mfg. Co., Wm.
Hopkins & Co., F. H.
Jenckes Machine Co.
Lecky & Collis
London Concrete Machinery Co.
Mussens Limited
Wettlaufer Bros.

Cupolas (Foundry)

Northern Crane works

Culverts

Pedlar People.

Cylinders for Liquefied Gases

Mannesmann Tube Co.

Derricks and Derrick Fittings.

American Hoist & Derrick Co.
Beath & Son, W. D.
Heppburn, John T.

Dredges

Beatty & Sons, M.
Browning Company.
Morris Machine Works.

Drills

Beatty & Sons, M.
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis
Star Expansion Bolt Co.

Drill Steel Sharpeners

Canadian Ingersoll-Rand Co.

Drop Forgings

Canadian Billings & Spencer, Ltd.

Dump Cars, Wheels, etc.

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Manitoba Bridge & Iron Works.
Schell Foundry & Machine Co.
Western Wheeled Scraper Co.
Weller Mfg. Co.
Sheldons Limited.

Dump Carts and Wagons

Deere Plow Co., John.
Troy Wagon Works

Electric Air Rock Drills

Canadian Ingersoll-Rand Co.

Electrical Machinery and Supplies

Ferranti Electrical Co.

Elevators

Roelofson Elevator Works.

Enamelled Brick

American Enamelled Brick & Tile Company

Engines

Boving Company of Canada
Canadian Buffalo Forge Co.
Canadian Sirocco Co.
Ingilis Co., John
Jenckes Machine Co.
Laurie & Lamb
Leonard & Sons, E.
McDougall Caledonian Iron Wks.
Mussens Limited
Sturtevant Co. of Can Ltd., B. F.
Waterous Engine Works Co.
Wettlaufer Bros.

Engineers (Civil and Mechanical)

Bowman & Connor
Campbell, R.
Chipman & Power
Dominion Engineering & Inspection Company.
Farmer, John T.
Galt Engineering Co., John
Lea & Ferguson
Mitchell, C. H.
Thorold Co., F. W.

Excavators

Austin Drainage Excavator Company, F. C.
Brown Hoisting Machinery Co.
Municipal Engineering & Contracting Company.

Expansion Bolts

Star Expansion Bolt Co.

Expanded Metal

Mannesmann Tube Co.
Pedlar People Limited.

Exhaust Heads

Canadian Buffalo Forge Co.
Sheldons Limited
Sturtevant Co. of Can. Ltd., B. F.

Fans

Canadian Sirocco Co.
Sheldons Limited.

(Continued on page 12)



Built for C.P.R. Montreal

Canadian Plant Chicago Bridge & Iron Works, BRIDGEBURG, ONTARIO

Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

WRITE TO-DAY FOR CANADIAN ILLUSTRATED CATALOGUE NO. 15

OFFICES: Bridgeburg, Ont., 130 Janet St.
Chicago, Ill., 1360 W. 105th St.

SHOPS: Bridgeburg, Ont.
Chicago, Ill.
Greenville, Pa.

CONTRACTORS' EQUIPMENT

PILE HAMMERS

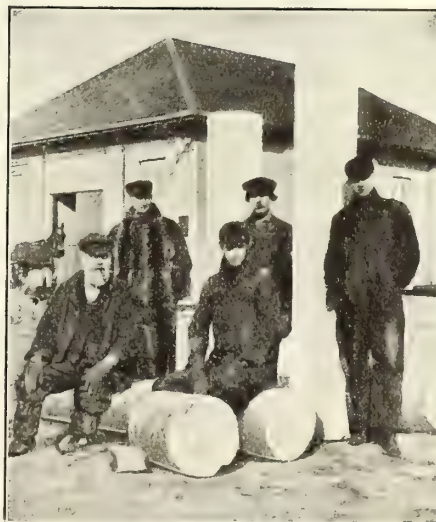
An 800-pound piston that strikes 4 powerful blows every second, is the effective energy behind our 5000-pound Sheet Piling Hammer.

The remarkable power of this hammer could not be attained without our new Accelerating Piston. This simple and basic improvement is broadly covered by patents and can only be had with McKiernan-Terry Pile Hammers.

CORE DRILLS

The 16 in. hard limestone cores shown here were taken out by one of our Type "C" McKiernan-Terry core drills operated by the Corporation of Winnipeg. We can furnish machines for taking out cores up to 30 in. in diameter.

We carry a full line of spare parts and drilling tools at all our District Offices.



CANADIAN ALLIS-CHALMERS, LIMITED

Manufacturers of: Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Locomotives, Logging Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Turbines, Structural Steel Transmission Machinery, Turbine Pumps, Water Pipe, Water Wheels.

HEAD OFFICES: TORONTO. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert

GURLEY TRANSITS

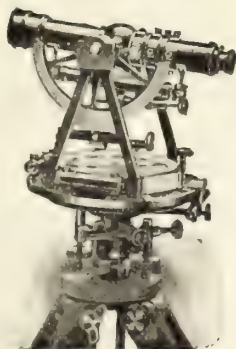
are guaranteed in perfect adjustment for immediate use when received by the purchaser, and to give entire satisfaction in service.

Send for new illustrated booklet

W. & L. E. GURLEY, Troy, N.Y.

Makers of Engineering Instruments since 1845.

Branch Factory, Seattle, Wash.



No. 28 Light Mountain Transit

AN OPPORTUNITY

Local Agents Wanted in

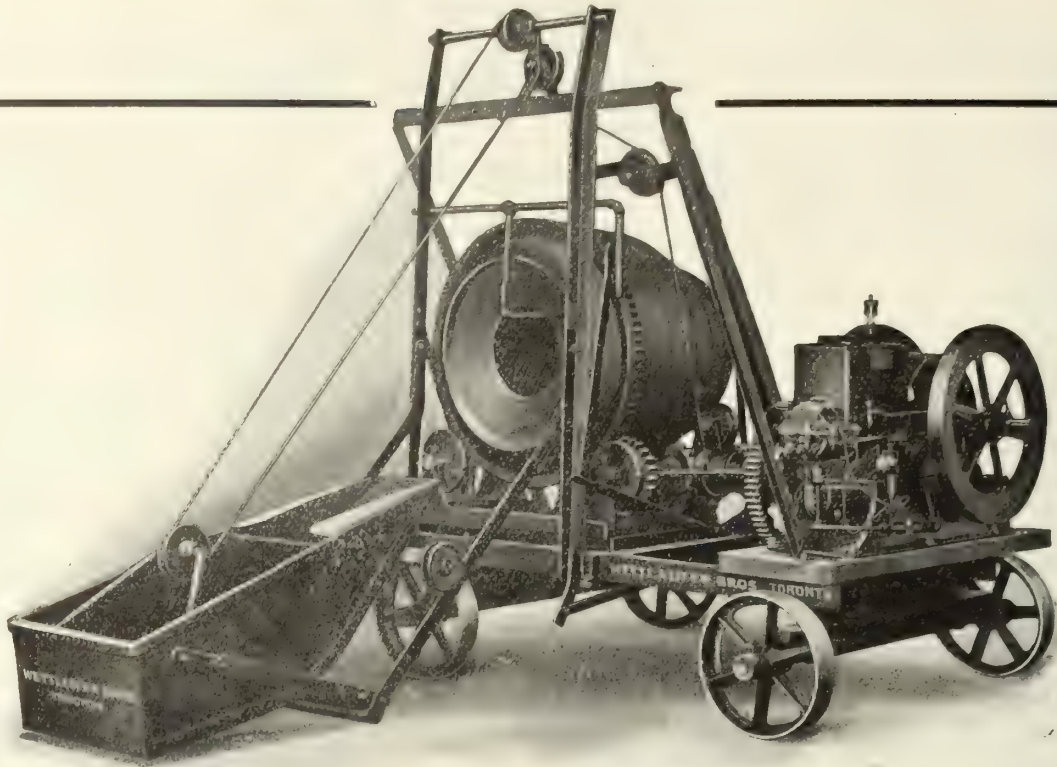
Quebec, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver

Water Filters 1,000 to 1,000,000 Gallons a Day
Refrigerating Machinery 1/4 to 60 Ton Daily Capacity
Water Purifiers 4 Gallons to 5,000 Gallons a Day

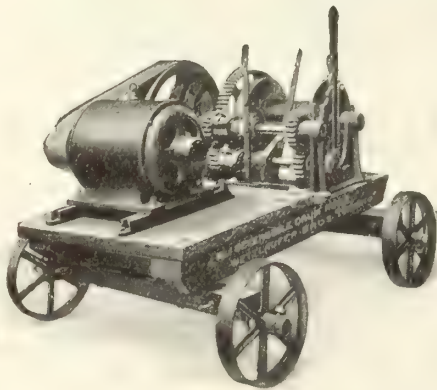
Refrigerators and Refrigerating Boxes for Ice or Machine Refrigeration
Hotel, Restaurant and Saloon Equipment and Supplies

EQUIPMENT & SUPPLIES, LIMITED

302 MCGILL BLDG., MONTREAL, P. Q.



Mixers and Hoists

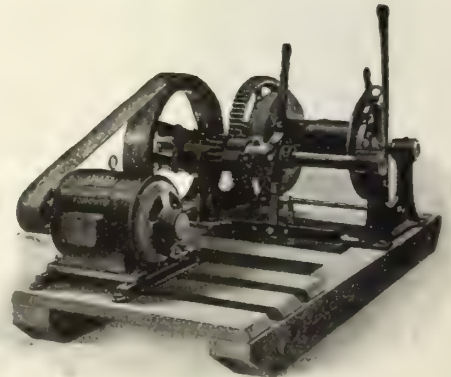


When it is time to buy new equipment be sure and examine the Wettlaufer line or Heart Shape Drum Mixers and Hoists.

Wettlaufer Mixers are famous the country over for their thorough mixing.

Wettlaufer Hoists are made in fourteen different types and sizes.

Attend a daily demonstration at any branch.



Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

AGENCIES:

A. E. Hodgert, Regina, Sask.; Maysmith & Lowe, 1057 Mears St., Victoria, B.C.; A. R. Williams Machinery Co., 15 Dock St., St. John, N.B.; The Canadian British Engineering Co., Ltd., 324 Smith St., Winnipeg, Man.; R. F. Mancill, 117 10th Ave. East, Calgary; The Hallman Machinery Co., 374 Alexander St., Vancouver, B.C.; J. L. Lachance, Ltd., 363 St. Paul St., Quebec; Wettlaufer Bros., 316 Lagachetiere St. W., Montreal.

One Municipality Saved \$92,000

**By advertising their tenders in the "Contract Record."
This page tells about it—briefly.**

A representative body in a Western Canada city thought their taxes were getting too burdensome. They decided to investigate. They appointed an engineer with an established reputation to look into their civic methods and expenditures. This engineer studied the situation carefully and made a comprehensive report.

Now, we are not going to ask you to read over all that report—we'll give you the kernel of it. The engineer said,—

**"Lack of Competition in City Works Has Much
To Do with High Taxes."**

Perhaps you will say you knew that before; perhaps, that you don't believe it. Read the exact statement bearing on this subject, taken, word for word, from the engineer's report, a copy of which is on file in this office:

"I have gone carefully through the "Contract Record" for the year 1913 and find that ninety-five cities, towns, provinces, railroads and commissions, including the Greater Winnipeg Water District (of which yours is a part), from the Atlantic to the Pacific, in Canada, have advertised for tenders, the contracts for which reach the sum of approximately two hundred and fifty million dollars; and yet St. Boniface is the exception. The only time your city appears is in connection with the bridge piers and your secretary-treasurer told me that the reason this was done was because there was no contractor in the city who would finance the undertaking. This advertisement resulted in the successful tenderer being \$92,000 lower than the next bidder, the successful men being outsiders. It is not unreasonable to suppose that this sum was saved by the advertisement being spread over Canada. A ten per cent. saving on the contract price means that debentures selling at 90, as they did this year, bring par; or selling at 104 as in 1912, bring 115—an unheard-of price. The local improvements in your city have cost over Two Million Dollars, and a ten per cent. saving would have enriched your treasury approximately a quarter of a million."

The "CONTRACT RECORD" saved this municipality \$92,000 or 10% of the total contract. The advertisement cost \$5.00. Would you rather have \$5.00 or 10% of your 1914 estimates?

When you are in the market for material or labor send us your advertisement. We will save you money.

Contract Record
and **Engineering Review**

ESTABLISHED 1886

220 King Street West, Toronto

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

VITREOUS FACE BRICK



OUR BRICK SHOWROOM IN MAIL BUILDING

Keep the following Names
in Mind when Ordering
High Grade Brick.

Beaver Clay Mfg. Co.

Columbus Brick and
Terra Cotta Co.

Hydraulic-Press Brick
Co.

Hocking Valley Fire
Clay Co.

Kushequa Brick Co.

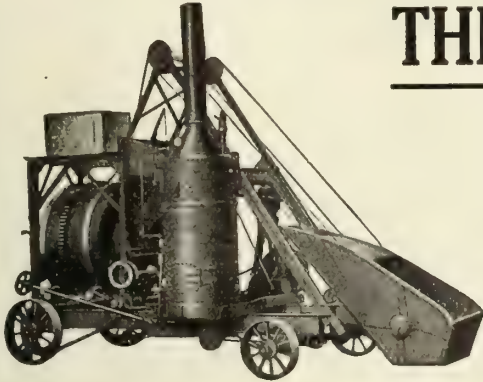
Ohio Mining & Mfg.
Co.

Pearl Clay Products
Co.

Tiffany Enameled
Brick Co.

BLACK BUILDING SUPPLY CO., LTD. - TORONTO

WHY are we the Largest Manufacturers of ? Concrete Machinery in Canada ? THERE MUST BE A REASON



Rear Discharge Traction Mixer. This machine is also equipped with Boom.

The reason is that our machines have always been made up to a standard, not down to a price. This fact has been recognised by the many users of concrete machinery, with the result that the demand for London machines is steadily growing. This increase in trade has from time to time necessitated the extension of our business, until to-day we stand alone as the largest manufacturers of the highest grade concrete machinery in Canada.

We also manufacture a full line of hoisting engines and contractors' equipment.

London Concrete Machinery Company, Limited

Head Office and Factory: Cabell St. and Kitchener Ave., London, Ont.

BRANCHES:

WINNIPEG (445 Main St.) W. H. Rosevear, Mgr.

CALGARY (622 9th Ave. W.) P. D. McLaren, Mgr.

TORONTO (112 York St.) F. D. Emsley, Mgr.

HALIFAX (68 Upper Water Street) R. R. Power, Manager

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MOOSE JAW, Sask. Bridge & Iron Co., Ltd.

REGINA, H. A. Knight

FORT WILLIAM, Northern Eng. & Supply Co.

MONTREAL, Foss & Hill Mach. Co.

QUEBEC, A. D. Masson

Sherardized Herringbone Lath



Best Metal Protection

is protected by the very latest and best development in the art of galvanizing. Professor Burgess, Metallurgist of the University of Wisconsin, reports that it took him 304 minutes to dissolve in dilute acid, a given amount of filings from the sherardizing coating. It took only 20 minutes to dissolve the same quantity of filings from hot galvanizing.

When you specify a galvanized metal lath, you do so because you want the very best. Then why not specify the best galvanized lath—SHERARDIZED HERRINGBONE ?

Clarence W. Noble,

General Sales Agent

Winnipeg

117 Home Life Building, TORONTO

Montreal

The Metal Shingle & Siding Company, Manufacturers

CLASSIFIED INDEX TO ADVERTISEMENTS—CONTINUED

- | | | | |
|---|---|---|---|
| Field Instruments
Gurley, W. & L. E. | Glass
Consolidated Glass Co.
Hobbs Mfg. Co.
Luxfer Prism Co.
Toronto Plate Glass Imp't'g Co. | Heating Apparatus
Canadian Buffalo Forge Co.
Canadian Sirocco Co.
Sheldons Limited | Lighting and Pumping Installations
Lister & Co., Ltd., R. A. |
| Filters
American Water Softener Co. | | Hoisting Engines
Canadian Allis-Chalmers, Ltd.
Canadian Fairbanks-Morse Co.
Wettlaufer Bros. | Locomotives
Boving Company of Canada
Canadian Allis-Chalmers, Ltd.
Canadian Locomotive Company
Montreal Locomotive Works
F. H. Hopkins Co.
Mussens Limited |
| Fire Brick
Ontario Lime Co., Ltd.
Smyth & Ryan | Gravel Washing Plants
Dull Co., Raymond W. | | Metal (Anti-Corrosive)
Stark Rolling Mill Co. |
| Fire Escapes
Manitoba Bridge & Iron Works.
McGregor & McIntyre | Hammer Drills
Canadian Ingersoll-Rand Co. | Hydrants
Canada Iron Corporation
Gartshore-Thomson Pipe Co.
Kerr Engine Company | Metal Lath
Greening Wire Co., B.
Metallic Roofing Co.
Noble, C. W.
Pedlar People Limited.
Steel & Radiation Ltd |
| Fireproof Doors and Windows
Feather & Roadhouse
Mussens Limited
Pedlar People Limited.
Steel & Radiation Limited | High Pressure Pipe Lines
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Escher Wyss & Co.
Mannesmann Tube Company.
Pittsburgh Valve, Foundry & Construction Company | Ice-making Machinery
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Ferranti Electrical Mfg. Co.
Canadian Allis-Chalmers, Ltd. |
| Fuse (Safety Blasting)
Lecky & Collis | Hoists
Northern Crane Works.
Roelofson Elevator Works | Insulating Compounds
Standard Underground Cable Co. of Canada, Limited | Meters, Water
Hopkins & Co., F. H.
McDougall Caledonian Iron Wks
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Canadian Ingersoll-Rand Co.
Jenckes Machine Co.
Hopkins & Co., F. H.
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Marsh & Henthorn
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Sturtevant Co. of Can. Ltd., B. F. | Interior Finish and Doors
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Morris Crane & Hoist Co., Herbert. |
| Folding Doors
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Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert. | Paints and Varnishes
Dominion Paint Works
Hopkins & Co., F. H. |
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Sheldons Limited
Canadian Sirocco Co. | | Kilns
Canadian Buffalo Forge Co.
Sheldons Limited
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Jamieson Lime Co.
Ontario Lime Co., Ltd. | |
| Gas Engines
British Mfrs. Assn. of Canada.
Original Gas Engine Co. | | | |
| Gasoline Engines
Wettlaufer Bros. | | | |



Ferranti Transformers

A transformer to be efficient must be economical to install, economical to operate and must have a minimum of core and copper loss. These good points will be found in Ferranti Three Phase Transformers.

Whether on the line or in the station Ferranti Transformers will give all-day high efficiency.

The design is very substantial and all parts are easily accessible.

Let us quote you prices

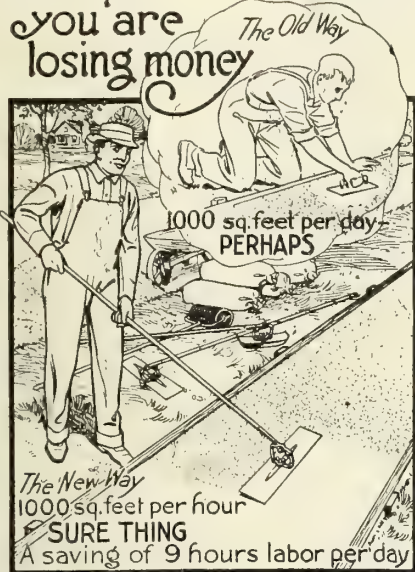
The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG

If you are not using
"ABRAM"
TOOLS

It is plain to be seen
 you are
 losing money



Abram Cement Tool Co.,
 Windsor, Ontario

The Most Complete and
 Up-to-date Line of Earth
 and Stone Handling Ma-
 chinery in the Continent
 of America.

**DUMP CARS—SCRAPERS—
 ELEVATING GRADERS—
 DUMP WAGONS—**

Write for Catalogue

Western Wheeled Scraper Co.

AURORA, ILLINOIS

Earth and Stone Handling Machinery

Dominion Equipment & Supply Co., Winnipeg-Calgary-
 Edmonton—Agents for Manitoba, Saskatchewan & Alberta

Canadian Equipment Co., Montreal
 Agents for Eastern Canada

Macadam Roads



*must be built
 of a*

Tough Stone

*that
 will cement*

WE HAVE IT

The Hagersville Contracting Company, Limited
 Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

Partition Hangers
Springer, O. T.

Paving and Paving Materials
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Aztec Oil Asphalt Co.
Baker Co., R. D.
Barber Asphalt Paving Co.
Dominion Creosoting Company
Ontario Asphalt Block Co.
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Greening Wire Co., B.

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American Spiral Pipe Works
Canadian Allis-Chalmers, Ltd.
Canadian Pipe Co.
Dominion Concrete Co.
Gartshore-Thomson Pipe Co.
Mannesmann Tube Company.
National Concrete Mfg. Co.
National Iron Works
National Pipe & Foundry Co.
Pacific Coast Pipe Co.
Piggott & Co., Thos.
United States Cast Iron Pipe Co.
Vancouver Wood Pipe & Tank Company.
Walsh Plate & Structural Works.

Pile Driving Machinery
American Hoist & Derrick Co.
Browning Company
Brown Hoisting Machinery Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis

Pipe Fittings and Flanges
Pittsburgh Valve, Foundry & Construction Company

Plumbing Supplies
Mueller Mfg. Co., H.

Planing Mill Exhausters
Canadian Buffalo Forge Co.
Sheldons Limited
Canadian Sirocco Co.

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Alabastine Hardmortar Co.
Albert Mfg. Company
Britnell & Company
Ontario Lime Co., Ltd.

Plumbing

Dietrich Limited

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Canadian Ingersoll-Rand Co.

Portable Saws

Canadian Fairbanks-Morse Co.

Portable Track

Bechtels Limited

Pumps and Pumping Machinery

Beatty & Sons, M.
Boving Company of Canada
British Mfrs. Assn. of Canada.
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Canadian Sirocco Co.
Cook, A. D.
Gray Mfg. & Machine Co.
Hamilton Mfg. Co., Wm.
Honig & Mock.
Inglis & Company, John
McDougall Caledonian Iron Wks.
Morris Machine Works.
Smart-Turner Machine Co.
Waterous Engine Works Co.
Mussens Limited
Ontario Wind Eng. & Pump Co.
Wettlaufer Bros.

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Canadian Ingersoll-Rand Co.

Power Engines

Inglis Company, John
Jenckes Machine Company
Canadian Allis-Chalmers, Ltd.
Waterous Engine Works

Quarry Machinery

Canadian Allis-Chalmers, Ltd.
Canadian Ingersoll-Rand Co.
Improved Equipment Co.
Lecky & Collis
George Anderson & Co.
Rock & Power Machinery, Ltd.

Radial Brick Chimneys
H. R. Heinicke Inc

Railway Supplies

Gartshore, John J.
Hopkins & Co., F. H.
Lecky & Collis
Mussens Limited

Refrigeration Machinery

Equipment & Supplies, Limited.
Linde British Refrigeration Co.

Reinforcements, Concrete & Steel

Brown Hoisting Machinery Co.
Canada Steel Co., Ltd.
Canada Wire & Iron Goods Co.
Dominion Iron & Steel Co.
Greening Wire Co., B.
Pedlar People Limited.
Steel & Radiation Ltd.
Trussed Concrete Steel Co.
Turner, C. A. P.

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Barber Asphalt Paving Co.
Asphalt & Supply Co.

Road Machinery

Dore & Fils
General Car & Mach. Works
Lecky & Collis
Morrison & Co., T. A.
Mussens Limited
Waterous Engine Works Co.
Western Wheeled Scraper Co.

Revolving Stone Screens

Greening Wire Co., B.

Rubber Belting

Canadian Fairbanks-Morse Co.

Roofing Material

Asbestos Mfg. Company
Barber Asphalt Paving Co.
Bird & Son
Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Metallic Roofing Company
Noble, Clarence W.
Paterson Mfg. Co.
Pedlar People Limited.

Safes and Vaults
Taylor, J. & J.

Sand and Gravel

Ontario Lime Co., Ltd.
Sand and Supplies Limited
York Sand and Gravel Co.

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Canada Wire & Iron Goods Co.
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Weller Mfg. Co.

Sewerage Ejectors

British Mfrs. Assn. of Canada.

Sewer Pipe

Britnell & Company
Canada Iron Corporation
Dominion Sewer Pipe Co.
Gartshore Thomson Pipe Co.
National Iron Works
Nova Scotia Clay Works Ltd.
Ontario Lime Co., Ltd.
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.

Sewer Trenching
Lecky & Collis

Sound Deadening

Cabot, Inc., Samuel

Stains, Shingle, Cement & Brick

Cabot, Inc., Samuel

Stair Builders

McGregor & McIntyre

(Continued on page 16)

What Big Contractors

Say About This Koppel Car

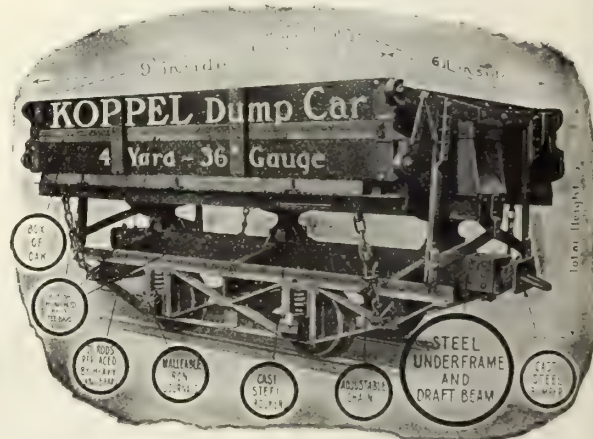
Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.



Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria

Good Roads Stay Good if made with—Dundas Stone

For Resistance to Wear, for Hardness, for Toughness, for Cementing value, it stands the test.

Good for Heavy and Light Traffic. Your Maintenance account after the roads are finished—reduced to a minimum. Road Superintendents, Engineers, get a copy of tests of our Stone, made by the best authorities on this Continent.

Fill in coupon at bottom of this advertisement, and same will be mailed without any obligation whatsoever to you.

Canada Crushed Stone Corp. Ltd.
DUNDAS, ONTARIO

Canada
Crushed
Stone Co.
Ltd.

Dear Sirs
Send me free a
copy of Tests of Dun-
das Stone.

Name

Address

Occupation.....

NOTE THE PERPENDICULAR POSITION OF THE Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

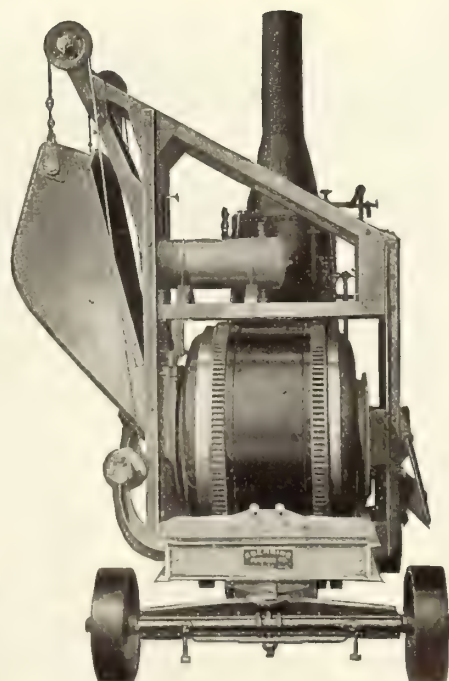
So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

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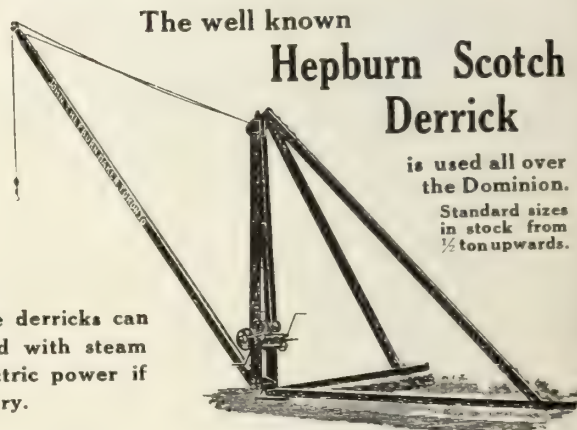
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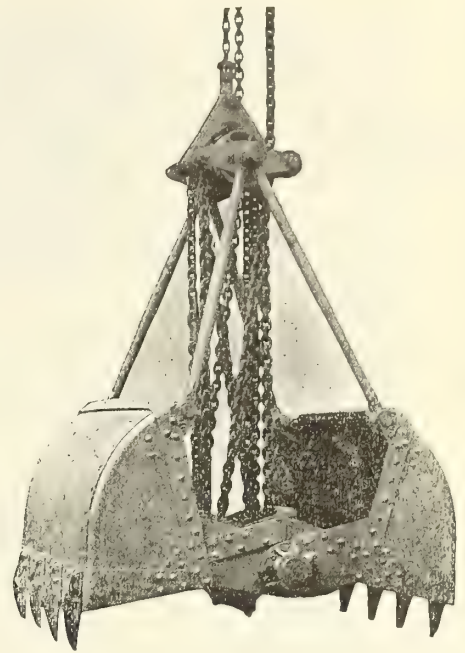
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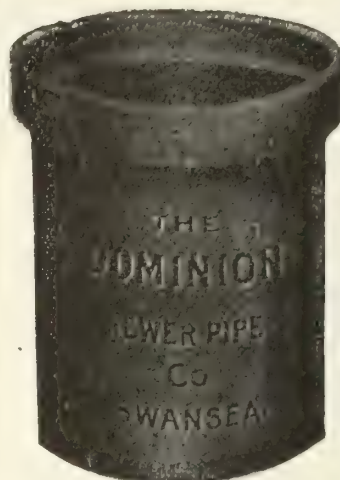
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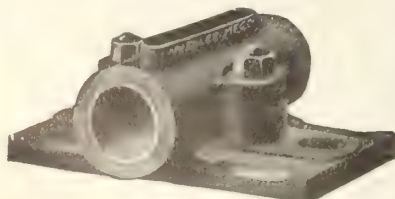
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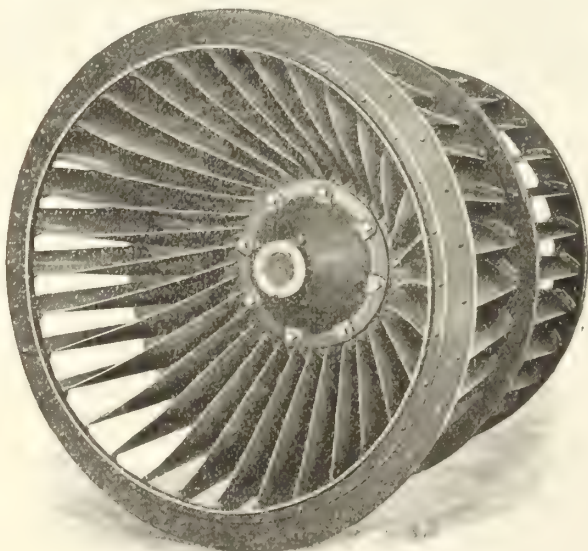
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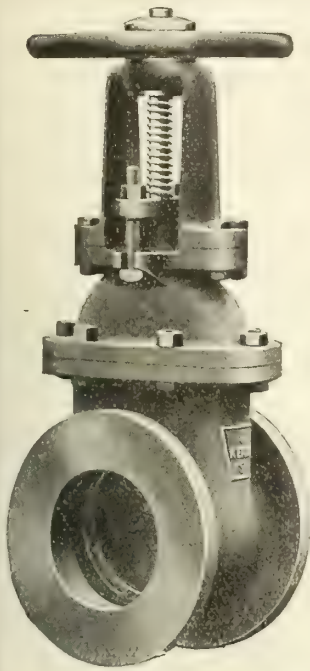
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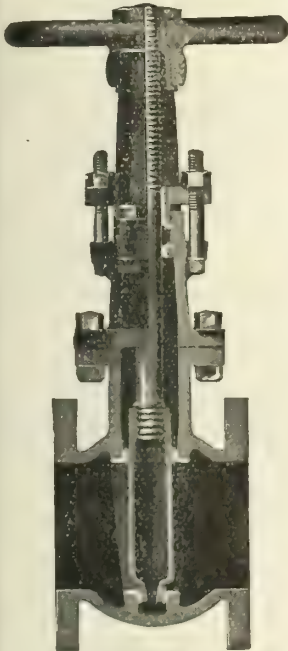
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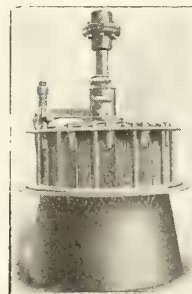
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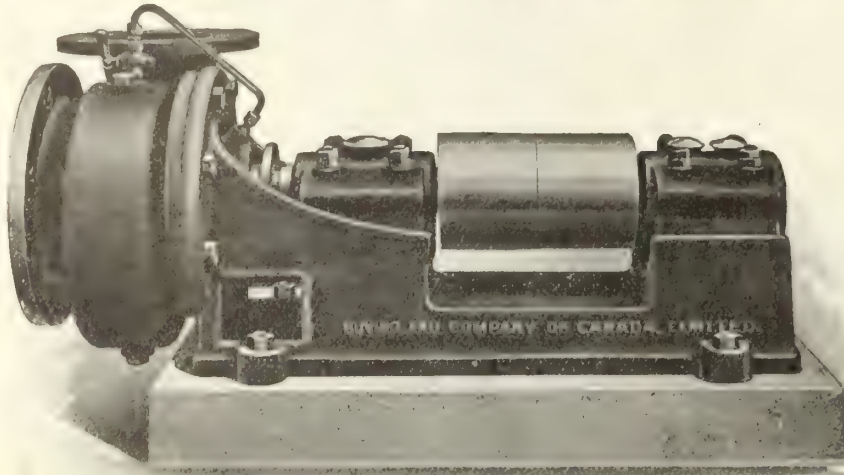
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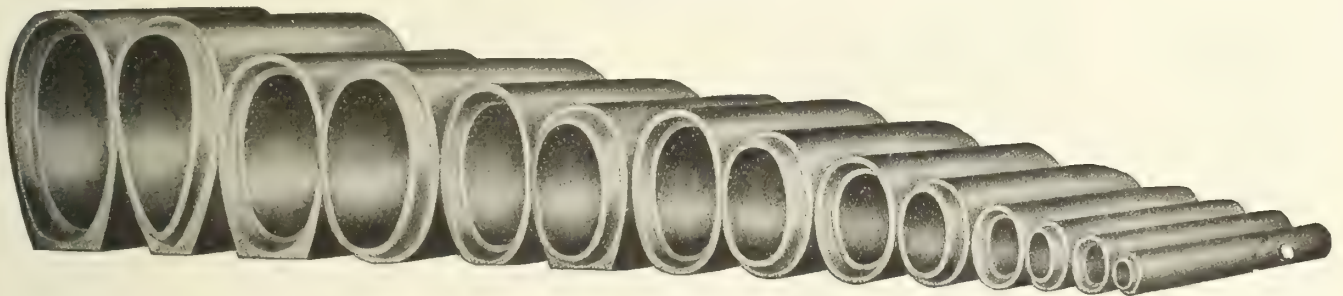
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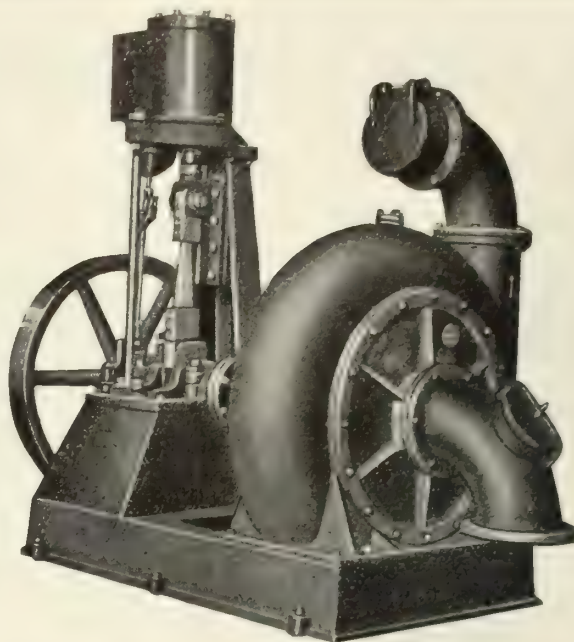
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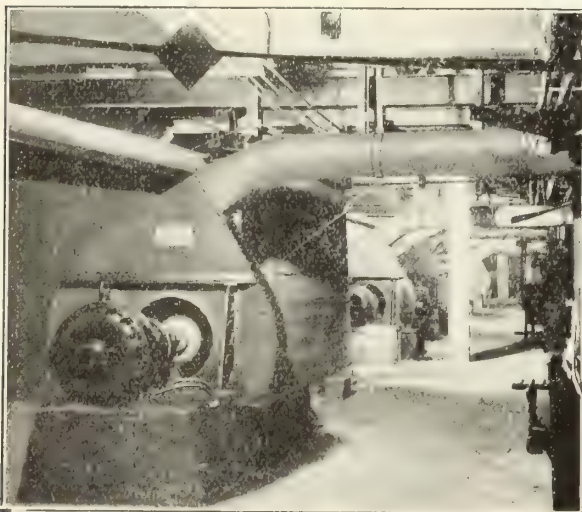
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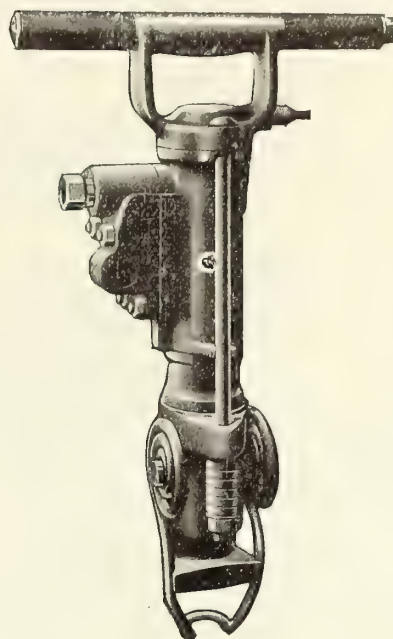
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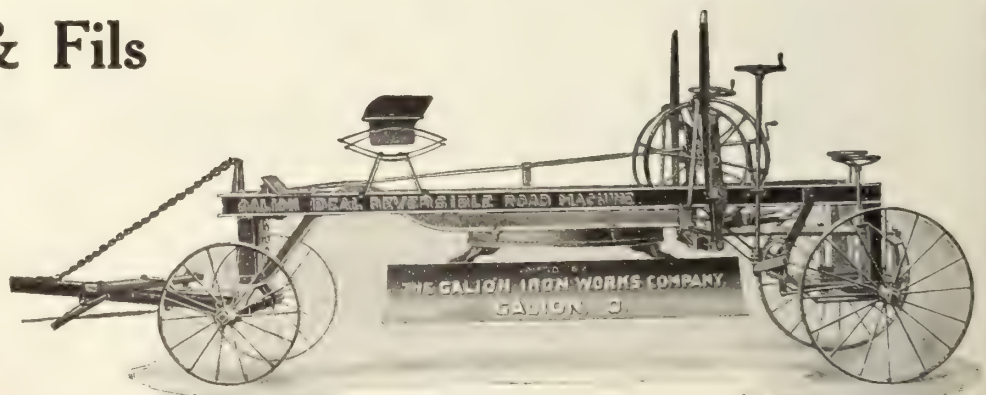
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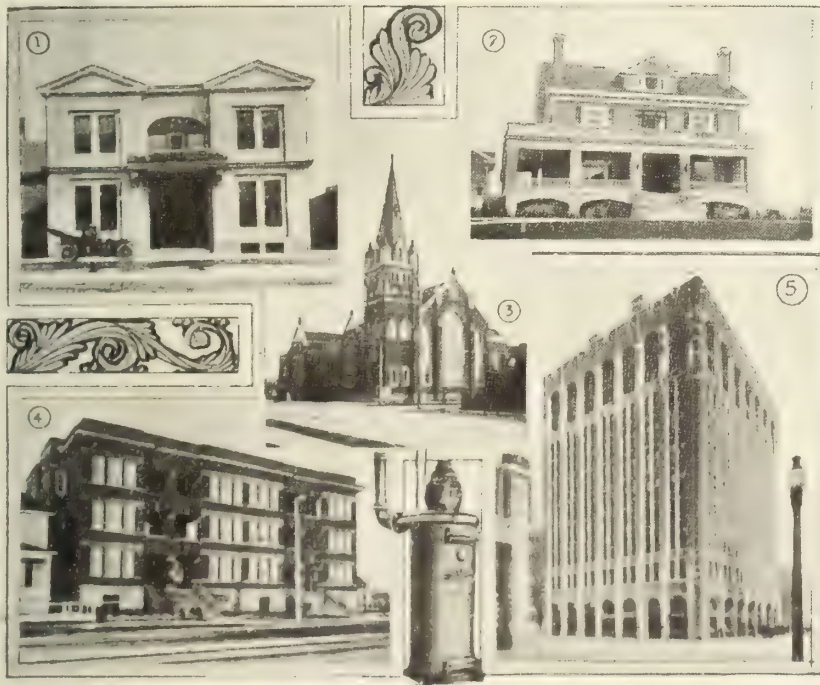


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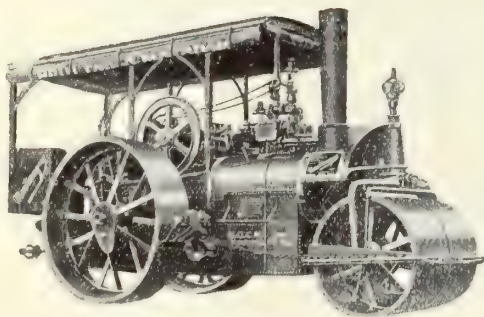
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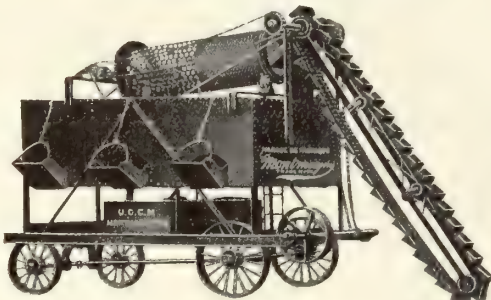
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2. O. G. Davenish, residence
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3. First Baptist Church
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4. Connaught Apartments
 Architect, J. J. O'Gara
5. Herald Building
 Architect, Brown & Vallance, Mon.



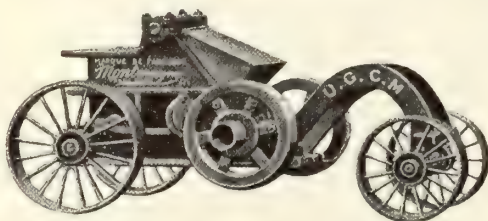
The Montmagny Plant.



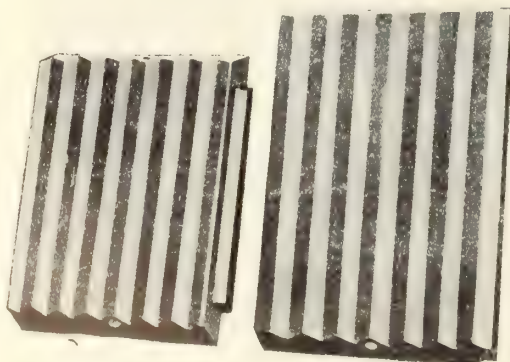
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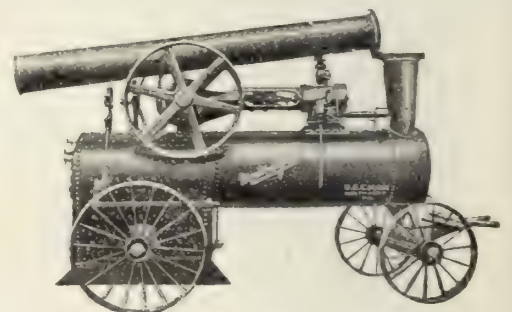
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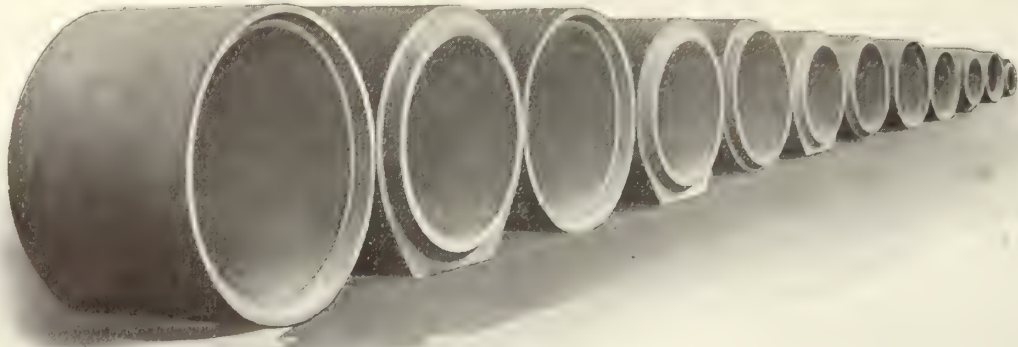
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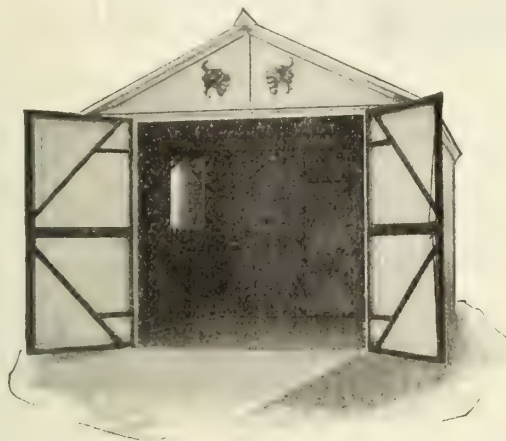
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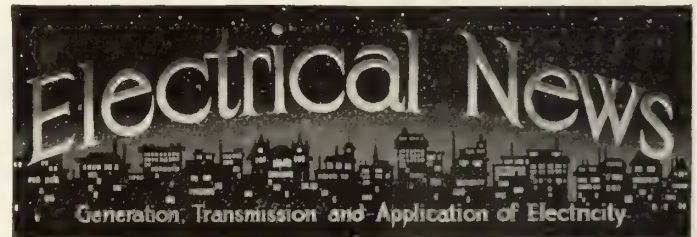
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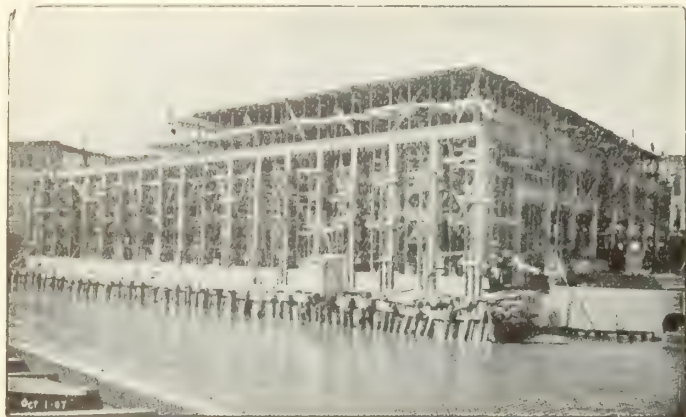
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Contract Record

ESTABLISHED 1856

and Engineering Review

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March 11, 1914

No. 10

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Unsavory Contract Procedure

WE hear that a section of the contracting community of London, Eng., is indignant over the action of the Borough Council of Bermondsey, a suburb of the metropolis, in permitting the lowest bidder for a certain building to amend his tender to the extent of some five hundred dollars. Such conduct on the part of a public body is severely condemned, it being held that such a policy is likely to destroy the faith of contractors in public tendering.

The defence is that the accepted tender was a great deal lower than the next bid and that the authority did not desire to take advantage of an obvious mistake.

We have little part in local contracting procedure in England, but we cannot refrain from commenting briefly upon this practice as illustrating something to be avoided in Canada, more particularly since it is generally contended that the ethics of contracting in England occupy a higher plane than on this side of the water.

Tendering is largely speculative, and as such it can never be wholly above suspicion; but any recognition of this on the part of authorities—any latitude which admits of such an easy resort as tampering with bids after they have been sent in, should be strictly tabooed. We do not hold for one moment that an authority should have no power of discrimination in the matter of releasing a man from his bid; because, obviously, it would be poor policy to hold him to an inordinately low figure and run the risk of an inferior job, scamped workmanship, or fraud in some other guise. What we contend is that a substantial claim to unwitting error once established the award should pass to the next lowest bidder—in other words, "the lowest bidder but one."

Some years ago, by the way, the London Correspondent of this journal, whose letter is published in another column, came forward with a suggestion that contracts should be awarded, not to the lowest bidder, but to the lowest bidder but one. The case that has arisen at Bermondsey would appear to be an argument in favor of putting this suggestion into effect.

Certainly it is an outrage upon those who play the game in good faith to allow any addition or subtraction once the hands have been shown.

Engineers' Estimates in Contracts

THE relation between contractors on the one side and municipalities and their engineers on the other is one which has of late years received considerable attention; but there is still much to be done before these relations will have reached the point where they are fair to all parties and adapted to securing the best results. There is still a tendency on the part of the city to consider the contractor a more or less of a highwayman with whom it is unfortunately necessary to have occasional dealings; and there are still engineers not possessed of that judicial spirit with which they should undertake the functions of unprejudiced arbitrator with which they are endowed by most contracts, says the Municipal Journal.

One point in which it is claimed the engineers are unfair to the contractors in many cases is that of the engineers' estimates of quantities and costs—either by not giving them or by an unfair use of them. In fact, a prominent contractor calls attention to the custom

of asking for a lump bid for a piece of work for which the plans and specifications are submitted but requiring the contractor to figure out the quantities himself. This, he states, is unfair to the contractor, as an error on his part in figuring out the quantities would either cause his bid to be too high and thus deprive him of the contract, or else it would be too low and cause him to lose money on the work. Moreover, he believes that it would contribute to collusion between contractors, in that they would naturally compare notes as to quantities and thus open the way to a "gentlemen's agreement" as to prices, to the disadvantage of the city. In most cases the engineer has already calculated the quantities, and there would seem to be no good reason why he should not state them.

The more common method (in this country, at least) is for the engineer to state the estimated quantities of each item and compare the bids on the basis of such quantities. It is generally provided, however, that these quantities may be increased or decreased during the construction of the work, and in the majority of contracts no limit is placed to such change. Ordinarily little exception can be taken to this method, since it must be realized that in most work it is impossible to fix beforehand the exact quantities of each item necessary to complete the work. Contractors have complained, however, that this clause permits altogether too much freedom to the city, and that a certain item could be increased not only five or ten per cent., but ten-fold or more, or could be similarly diminished in quantity. Thus, for instance, a contractor might assemble on the ground an expensive equipment for removing rock from water pipe trenches, only to have the city decide after the work was begun to alter the route of the trench so as to avoid rock cutting altogether, in which case the contractor gets no return for extensive rock work. It would seem only just to the contractor to set a limit to the amount by which the quantity of any item could be increased or decreased; and then, if it is necessary to exceed this limit, to have the additional amount come under the head of special work, the allowance for which is to be agreed upon by mutual consent or arbitration, or by prices or allowances fixed in the contract.

Are Engineering Prospects Improving?

DURING the last few years the history of engineering appointments in Canada has been anything but encouraging, and upon more than one occasion we have felt constrained to write in a pessimistic vein concerning the prospects offered by the profession under existing conditions; so that having obtained a like consolation from a perusal of some editorial observations on the part of the Engineering Record we are only too pleased to preserve the essence of that journal's sentiments. The Engineering Record finds that the average engineer is better paid than members of the clerical, legal and medical professions and considers that the outlook is steadily growing better. We quote our contemporary:

"Good salaries are more and more likely to come to competent men as the public realizes more and more the importance of their services from the standpoint of sheer economy, if nothing better. Still greater cause for encouragement is to be found in the demand for men of first-class engineering training in responsible executive positions. Mr. Waite, the city manager of Dayton, is a good example of the kind of fortune that is more and more likely to come the engineer's way. With the present trend of business such

opportunities are sure to develop more frequently. The whole engineering profession, for example, should have rejoiced when one of their brotherhood found his way to the head of the biggest electrical company in the country. Every large enterprise in the future will have to depend on a high grade of technical ability in executive positions. High finance is somewhat less popular than it was, and the plain stockholders are beginning to look about for men of tried ability to take the place of clever jugglers of securities. The spell is beginning to work, although slowly, and unless all signs go awry the next decade will see many big concerns getting down to first principles and depending on men who know how to do things superlatively well in their own lines of activity. Engineering, therefore, is going to look up instead of down, and the men who are now showing their capacity in minor positions have a better chance than ever of finding their reward."

Should Engineers Describe Their Failures?

ONCE more our Chicago contemporary, Engineering and Contracting, returns to a discussion of this subject upon which we commented in our issue of January 21 under the heading "My Greatest Mistake." Taking issue with us in our contention that the idea was all right in theory, but that it was impracticable and that few members of the engineering profession would survive any publicity given to their greatest mistakes, our contemporary makes out such an excellent case that we are only too pleased to quote the pith of the arguments adduced:

"To illustrate the character of failure which we had in mind let us assume that an engineer designs a concrete dam along well recognized lines for the greater part but differing somewhat from other dams in some important detail, for example, in the design of the flood gates. Let us suppose, also, that the design of the gate adopted seems to give promise of doing good service, and of possessing certain advantages over older types. Again, suppose that the designer describes his design in an article contributed to some technical journal and calls particular attention to the flood gate by illustrations and descriptive matter. Now our point was that should the gate prove deficient when put to the test the designer should give the same publicity to that fact that he gave to the first statement of what he believed his design would accomplish. We cannot think that our suggestion is impracticable or that its adoption would injure the reputation of the designer among thinking men who realize that mistakes of this nature are being made frequently and by everybody who does much work.

"Our contemporary* uses in an illustration of its views of the broader aspect of the description of engineering failures a reference to making a "mess" of the engineering for a city's water supply. A failure which can be characterized as a "mess" is usually described by others and unless the designer desires especially to state his side of the case there is little left for him to say. Moreover, "messes" of engineering work need no longer be made by those who will take the trouble to become well grounded in such fundamentals as the text-books set forth. If an engineer makes a failure of a system of pipe sewers it can have but slight interest to the profession as a whole, for thousands of engineers are now entirely competent to carry such works to a successful completion. But if an engineer tries out a new type of sewage tank and it fails his reputation will not suffer from a recital of his apparently sound reason for adopting the design and a statement of the tank's failure to accomplish the results desired."

* Contract Record.

Substructural Bridge Work by the Pneumatic Method

DURING the last few years the substructures of a number of important bridges have been built by the pneumatic method, the reasons for the adoption of which in a number of noteworthy cases are explained in this article. At the outset, reference may be made to an article relating to the substructure of the new C. P. R. bridge over the Red River, published in our issue of January 21, and to the article on the Mud Lake bridge in our issue of January 28. The data here given are in part supplementary to the descriptive matter contained in the above-mentioned articles, but the introductory portion is an entirely original feature, sev-

of construction, but it is possible to build the structure where all other methods would fail.

To emphasize the importance of this method it might be well to classify foundations in general in the order of their relative cost, provided, however, conditions are favorable for the use of the class or type selected. Class 1.—Spread footings. Class 2.—Piles. Class 3.—Piers constructed by the open method. Class 4.—Piers constructed by pneumatic method. Class 5.—Piers constructed by a combination of Classes 3 and 4.

Foundations under Class 1, spread footings, are usually placed on the soil a few feet below the ground



General view of the bridge under construction at Harrison Mills, B. C. For general elevation of this bridge see Fig. 3, page 288, and for description see page 291.

eral new structures are described and the whole is illustrated with illustrations furnished expressly for this journal. The article is abstracted from a paper given last month by Mr. John W. Doty, Vice-President and General Manager, Foundation Company, Limited, Montreal, before a general section meeting of the Canadian Society of Civil Engineers.

The Pneumatic Method

During the past few years the following bridge substructures have been constructed by this method: two bridges over the Red River at Winnipeg; bridge over the St. Lawrence River near Lachine; bridge over the Harrison River at Harrison Mills, B.C.; bridge over the St. Lawrence River near Quebec; bridge over Mud Lake, near Perth, Ont.

The pneumatic method has been developed to meet treacherous water and soil conditions, and to insure the founding of a structure on a suitable, properly prepared bottom in the shortest possible time and for the minimum cost considering the conditions encountered. It is naturally the most expensive method

level. This class of foundation may be subdivided into the following types:—timber grillages; concrete footings; reinforced concrete footings; steel grillages imbedded in concrete.

Foundations under Class 2, pile structures, are generally used where the material at the bottom of the footing is not capable of supporting the load and it becomes necessary to drive piles to some better strata of material in order to obtain a safe support. This class of foundation may be subdivided into the following types:—sand piles; wooden piles; concrete piles moulded in the ground; concrete piles built up, seasoned and then placed; steel tubular piles driven and filled with concrete.

Class 3, piers constructed by open method. These foundations are usually carried a considerable depth below the general ground level to hardpan or rock, and can be subdivided into the following types:—timber sheet pile constructed cofferdam; steel sheet pile constructed cofferdam; timber or steel boxes built up and sunk as excavation is made; timber-lined construction, or where the sides of the excavation are

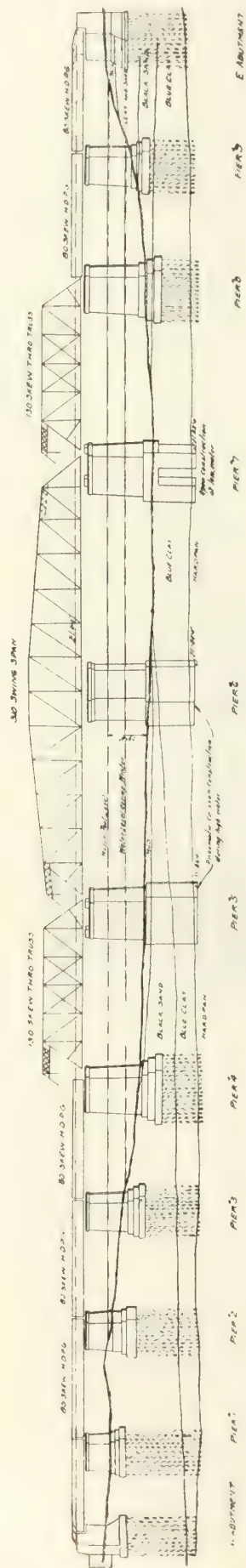


Fig. 1—General elevation Red River bridge No. 2.

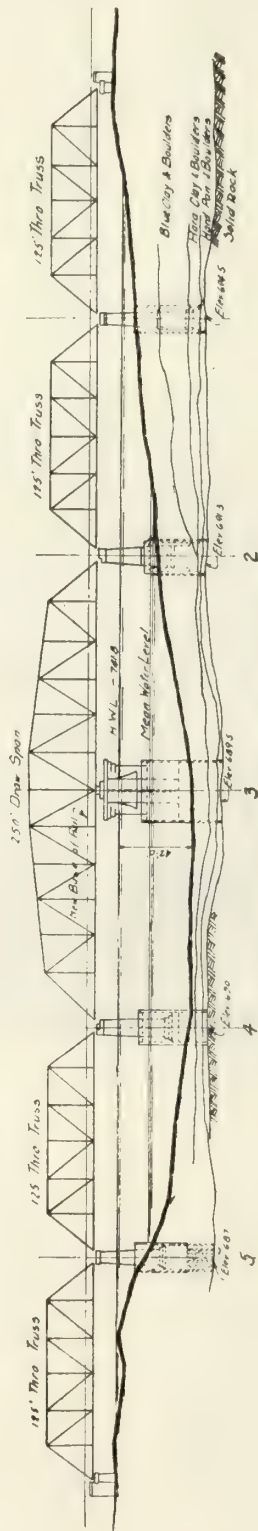


Fig. 2—General elevation Red River bridge No. 1.

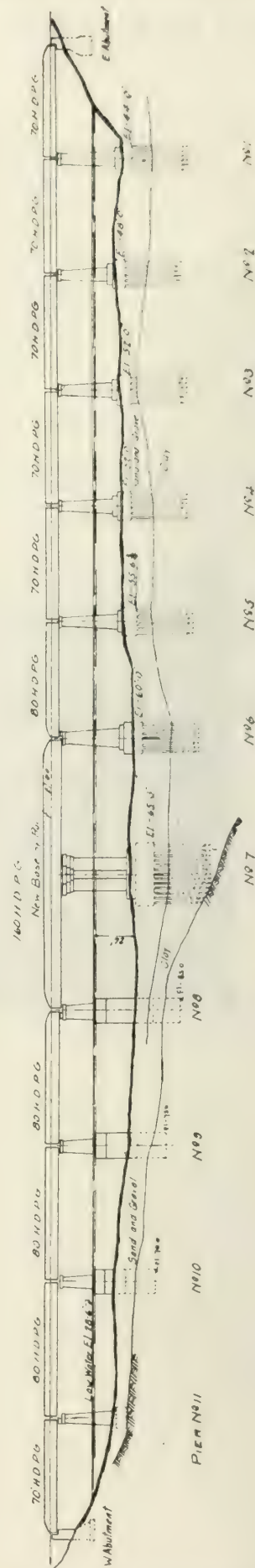


Fig. 3—General elevation Harrison River bridge.

lined with timber as the excavation is made; caissons built and filled with concrete before sinking; monolithic concrete caissons which are moulded before sinking.

Class 4, piers constructed by pneumatic method, are usually carried a considerable depth below the general level of hardpan or rock, but the limit of depth to which this method is practical is 100 feet below water level. This method can be divided into the following types:—caissons built of timber or steel filled with concrete before sinking; monolithic concrete caissons which are moulded before sinking.

Class 5, piers constructed by a combination of Classes 3 and 4. The two last types of Class 3 referred to can be readily commenced by the open method and completed by the pneumatic method.

The principal conditions governing the selection of the class and type of any foundation for any particular purpose are as follows:—(1) the magnitude and distribution of the loads to be supported; (2) the nature of the soil on the proposed site; (3) the depth to rock or to suitable bearing material below the water level; (4) the elevation of water level; (5) the value of the structure to be supported; (6) the surrounding conditions, such as adjoining structures; (7) speed of completion; (8) the possibility of the disturbance of the material in which the foundation is resting; (9) the economy of construction.

The type of foundation selected for any particular purpose should be the one that safely fulfils all the above conditions and is the cheapest to construct.

The importance of the foundations for structures makes it imperative that the engineer should take a conservative attitude in selecting the type to be used. Time limits the discussion in detail of the advantages and disadvantages of each particular type of foundation. However, it might be well to note the reasons for the failures of some of these types.

Class 1.—Overloading the soil.

Placing footings on a soil overlying a soil of lesser bearing value.

Designing eccentric footings and not taking into consideration the maximum pressure due to the load not being evenly distributed.

Designing reinforced concrete footings on the assumption that the pressure will act uniformly on the soil, no allowance being made for the lack of uniformity of the soil.

Placing heavy loads on reinforced concrete footings where they are extended below the water level.

Not carrying footings deep enough to prevent frost action.

Not carrying footings deep enough to prevent undermining by scour.

Not carrying the footing deep enough to provide protection against the material under the footing being disturbed by adjoining construction operations.

Class 2.—Wooden piles which have not been driven to a firm underlying stratum or driven to a sufficient penetration.

Wooden piles which are overdriven and broken.

Where a great many piles are driven at close centres it is, in many cases, impossible to drive all the piles to a firm stratum on account of compressing the upper strata. A

readjustment of the soil might take place and permit the structure to settle, as all the piles were not driven to a firm underlying stratum.

A steel tubular pile is as a rule overloaded and no allowances made for the reduced bearing value when the exposed steel has deteriorated, also due to the impracticability of founding the bottom of the pipe on a material capable of supporting the usual overload.

Class 3.—Failure of this class usually occurs when the foundations have not been founded on a suitable bottom, due to the impossibility of properly cleaning it off on account of the large quantities of water which are encountered.

Failures due not to the completed foundation themselves but to the fact that the method of construction would not prevent the flow of material which will probably cause damage to the adjoining property, especially if the water or soil conditions are treacherous.

Failure or the impracticability of constructing this type of foundation where large quantities of water are encountered, or the nature of the soil is such that the action of the water on the soil will cause it to flow, making the conditions impossible to reach the assumed bearing elevation.

Class 4.—Failures in this class are due only to poor workmanship or unavoidable accidents, but these, with the present day methods, are very improbable.

From the above data it will be noted that the pneumatic method is classified as the most expensive, but one that overcomes the difficulties in reaching a suitable footing and permits the proper preparation of the bottom on which to found the structure, and the construction below adjoining structures where water and soil conditions are serious, without damage to the adjoining structures.

The pneumatic method has developed during the last fifty or sixty years with the advent of the heavy and expensive structures. It might be of interest to note that this method is derived from the principles used in the diving bell. This appliance was conceived by the ancient Greeks, developed and used in America for the first time on bridge substructure work about the year 1860, the present method having been worked out during the last fifty years.

It might be of interest to explain briefly the principles of this method. A pneumatic pier usually consists of three parts, the working chamber, the shaft and the cofferdam. To this structure should be added the equipment necessary to control the air pressure, which is the air shaft, air lock and air supply pipe line. The working chamber can be explained as an inverted box with an open bottom, on which is placed a portion of the concrete shaft, and extending above and around the perimeter of this concrete shaft is the cofferdam. The steel air shafting is built into the concrete shaft and connects the working chamber with the air lock. The working chamber, air shaft and air lock are designed to withstand safely pressures of at least 50 lbs. per square inch, which is the practical limit of the pneumatic method.

The air lock consists of a shell with two diaphragm

plates to which are suspended two doors. These doors permit the passing of men and materials from the atmospheric pressure to the increased pressure in the working chamber without allowing any appreciable decrease of the higher air pressures in the working chamber. In addition to the equipment on each caisson, it is necessary to operate an air compressor plant.

The above outline gives the principle of the method and equipment for operation, and shows the reason for the expense in constructing work by this method.

Red River Bridge No. 2

The first work to be discussed is the construction of the piers for Red River Bridge No. 2, at Winnipeg. Fig. 1 gives the elevation of the bridge, showing the depth of water and the depth to rock, also the nature of material on the site overlying the rock. In general, the water in the river is approximately 28 feet in depth, while the rock is about 62 feet below water level. The soil overlying the rock varies from a stiff clay on the east bank to a fine flowing sand on the west bank, and in certain places both of these materials were found in different strata. Generally speaking, the soil in and about Winnipeg flows or is displaced by surcharged load or vibration, and although some clays might be loaded safely on the basis of two tons per square foot, the use of spread footings would be impracticable for a heavy or expensive structure, especially where vibration due to rolling stock would aggravate the conditions. Also on account of the general movement of the soil in this vicinity it is not possible to put a structure of this type on a spread footing at any cost.

Considering Class 2 or pile type of foundations, these were adopted for the two abutments and piers 2, 3, 4, 8 and 9, which supported the flanking or fixed

piers 5, 6 and 7 to hardpan or rock, which borings indicated would be encountered at a depth of 60 feet below water level, eliminating Classes 1 and 2.

Class 3, dredging types, were considered inadvisable on account of the stiff clay and sand strata which were encountered at the site of these piers. Stiff clay is a material which cannot be economically excavated from the inside of a box through any great depth of water. It was inadvisable to use the open cofferdam type and excavate in the open, on account of the numerous water bearing sand strata which were encountered at depths which were not economical for unwatering. Also because of the necessity of founding the piers on a uniformly hard bottom in the hardpan and at such depths below water level, it was impracticable to pump out the cofferdam in order to make this excavation in the open, and dredging this nature of material through the water at such depths is expensive and unreliable.

Another item which had to be taken into consideration was the time allowed to complete this structure. The plans were approved by the Government on December 28th and it was necessary that this structure be completed not later than September 1st, and an open method, if possible, with its numerous contingencies with this depth of water would be uncertain and date of completion not positive.

In conclusion, the reason for the adoption of the pneumatic method on this work was:—(1) the loads to be supported; (2) the vibrating load to be supported; (3) the elimination of any possible settlement or movement which might interfere with the operation of the drawspan, necessitating the pier being founded on good uniform hardpan or rock; (4) the impracticability of dredging or excavating the clays to hardpan through the water by any economical method; (5) the impracticability of unwatering; (6) the speed necessary in order to insure completion.

Pier No. 6 was the largest and last pier constructed. The working chamber was built on the shore and placed on the site on the 25th of June, 1913. It was bottomed by the 19th of August. This pier, which contained 3,192 cubic yards of concrete, was completed in 55 days from the date the caisson was placed on the site. The total substructure was completed by August 28th, or within eight month's time.

Pier No. 5 was constructed by the pneumatic method at high water period. Pier No. 7 was constructed by open method at low water period. It required twice the length of time as pier No. 5 and was considerably more expensive.

Red River Bridge No. 1

Fig. 2 shows the elevation of this bridge, the depth of water, the distance to rock, and the nature of material on the site overlying the rock. This structure is within three miles of the bridge known as Red River Bridge No. 2, and the general conditions are similar, except that the clay does not contain layers of sand as at the site of Red River Bridge No. 2. The work consisted of extending the piers of the old bridge for the purpose of double tracking. The old piers were constructed by the dredging method some years ago, and the substructure required approximately two years to complete.

The old piers were all carried to hardpan by the open dredging method, except pier No. 5, which was founded on piles. The reason for founding this pier on piles was on account of the impracticability of carrying the same to hardpan or rock by the open

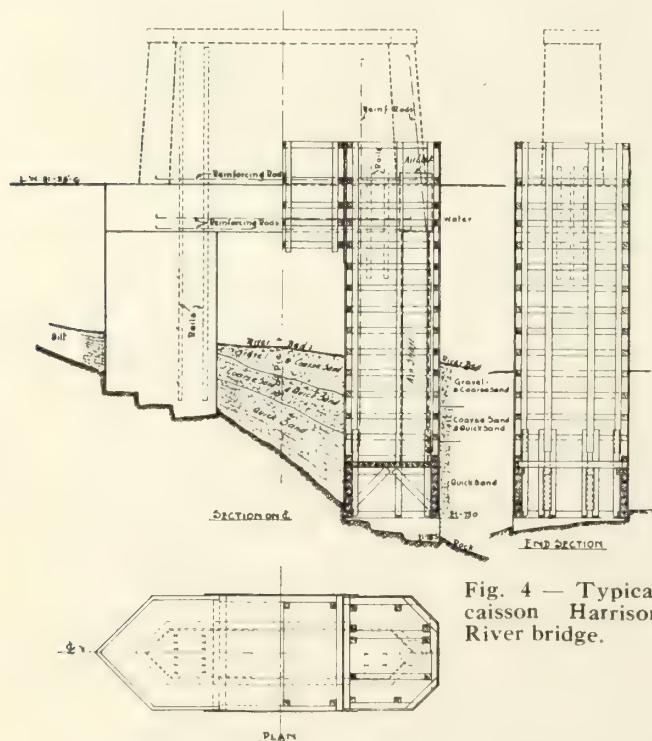


Fig. 4 — Typical caisson Harrison River bridge.

spans; but on account of the nature of the material and the general movement which has been referred to, it was deemed inadvisable to use this type on piers 5, 6 and 7, which supports the drawspan, and would cause trouble and inconvenience if any settlement or movement took place, whereas on the flanking piers a slight movement or settlement would not seriously affect the structure. For this reason it was decided to carry

method because of the material flowing into the caisson as the excavation was being made, and the impossibility of making progress in excavation sufficient to overcome the inflow.

The extension to piers No. 1 and 2 was built by the wooden sheet pile method (Class 3), which was practical on account of the stiffness and previous nature of the day. The extension to pier No. 5 was founded on piles. The excavations were made to the elevation of the old footing by the use of the steel sheet pile cofferdams.

Old piers Nos. 3 and 4 were founded on hardpan by an open dredging method and the concrete was deposited through the water. The probability was that some slight settlement had taken place during the past years, but had come to rest, and the only safe manner of insuring against even a slight settlement of the new portion of the piers when combined with the old was to carry the new portion of the piers to rock. This necessitated excavating several feet below the footings of the old piers, and to make this excavation economically, considering both the nature of the material and the absolute necessity of not disturbing the hardpan under the old portion of the pier, the pneumatic method was used.

As stated above, it required about two years to complete the substructure of the first portion of the bridge, whereas the extension of the piers had to be completed in less than seven months. The contract for this work was awarded in February, and the construction was all completed by August.

In reference to the use of the pneumatic method on the double tracking of the St. Lawrence River Bridge, this plan and method was used for the extension of the piers. The conditions existing and the means of overcoming the difficulties were similar to those found and overcome on the Red River Bridge No. 1. A number of the old piers of this bridge were founded on rock but a great many were resting on hardpan, and to eliminate any possible splitting of the piers when the old piers and the extension were bonded together, the extensions of all the piers were carried to rock. In one case it was necessary to carry them to a depth of 9 feet below the footing of the old pier. The greatest depth of water was 42 feet and the maximum current approximately 9 miles per hour.

Harrison Mills Bridge

This work is now under construction over the Harrison River, at Harrison Mills, B.C. Fig. 3 gives the elevation of the proposed structure, the depth of water to rock, and the nature of soil overlying the rock.

The soil being principally sand and gravel, with a little clay on the east portion of the bridge, it was deemed practical to build the eastern half of the bridge on wooden pile foundations, and the western portion of the bridge on rock by the use of the open caisson

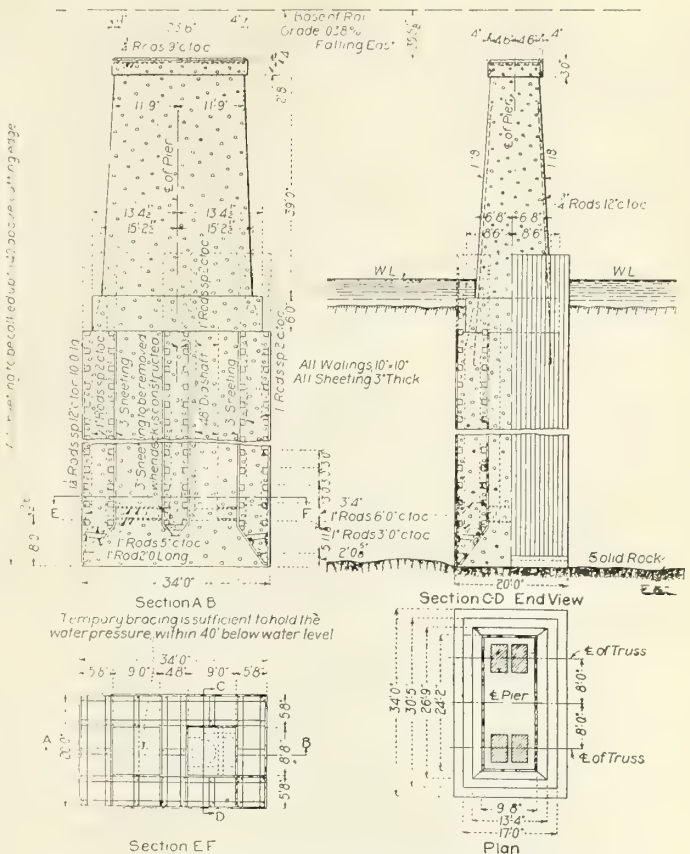


Fig. 6—Plan and sections of caisson and dimensions of pier No. 2, Mud Lake bridge.

method on account of the shallow depth of the rock. Additional borings made on the site after the work was begun showed that the rock on the western portion of the bridge sloped at an angle of from 30 to 40 degrees.

On pier No. 8 (Fig. 4), the depth of water was approximately 25 feet, the depth to rock on the downstream side of the pier was 30 feet, and the depth to rock on the upstream end of the pier 55 feet. The soil overlying the rock was principally sand and gravel with traces of clay. It was necessary to carry the footing of the pier into the river bottom at least 8 feet to protect the pier against scour. This depth would bring the downstream end of the pier on rock, whereas the upstream end would be approximately 25 ft. from rock. It was not practical to use a spread footing class of foundation as one end of the pier would be resting on rock and the other end on sand, gravel and clay, which would no doubt settle and cause it to slip out of line. It was also not practical to consider the use of piles on account of the short length of these at the downstream end of the pier. It was also not possible to construct an open dredging caisson in one mass at the

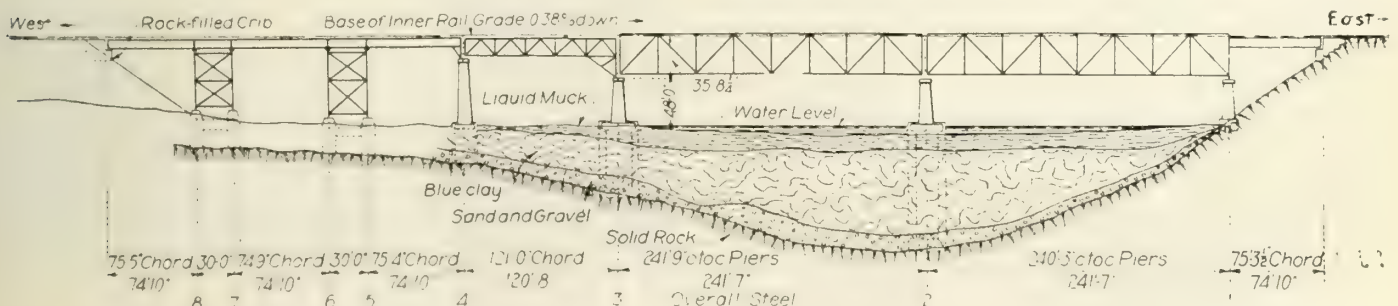
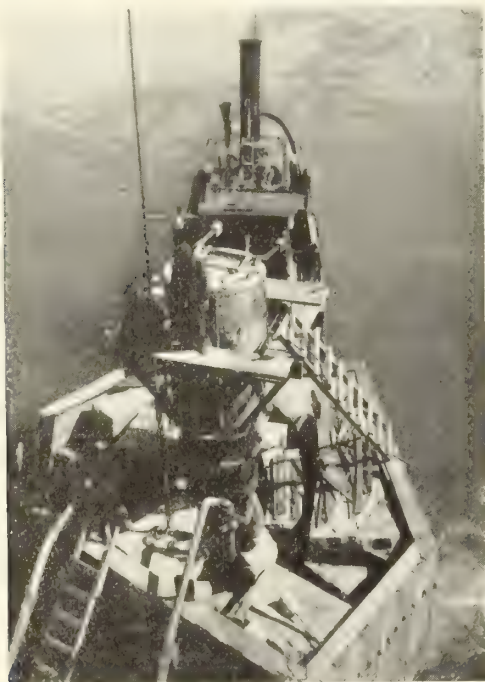


Fig. 5—Elevation of bridge over Mud Lake, Ont., showing type of construction and character of subsoil.

site of this pier, because of the steep slope of the rock and the large expense to be incurred if the rock was excavated sufficiently to enable the caisson to be carried to a uniform rock level.

For these reasons it was finally decided to found the pier on rock, using either an open method or pneumatic caisson on the downstream or shallow end and a pneumatic caisson, on account of the depth of the water, on the upstream end of the pier, the rock being stepped off in the working chamber so as to prevent sliding. It was also decided that the concrete shaft of the pier should be built on these two independent cais-



Pneumatic caisson, St. Lawrence River bridge.

sons, the shaft to extend to a depth of approximately six feet below low water to the coping, the whole design being reinforced so as to combine the two caissons, and the shaft to take up all strains to which this type of pier would naturally be subjected. This design and method of construction is being used on piers Nos. 8, 9 and 10.

The Quebec Bridge

On account of the magnitude of this structure it was necessary to found the piers on a stratum which would absolutely preclude the possibility of settlement, and to carry the footings to such a depth as to eliminate any possibility of scour.

The nature of the material on the south pier was such that pneumatic caissons could be founded on rock at an elevation of approximately 85 feet below the water level, and it was necessary to use this method in order to excavate to rock and properly prepare the rock surface. The north pier was founded on hardpan at a depth of approximately 60 feet below the water level. It was necessary in either case, in order to reach the stratum on which the piers were founded, to do the work by the pneumatic method as it was impracticable to remove the large boulders and other material by any dredging method, and when the hardpan or rock was reached, this bottom had to be prepared in such a manner as to preclude any possibility of settlement.

In the north pier, which did not reach rock, the engineers carried on an exhaustive test on the soil before permitting any concrete to be placed.

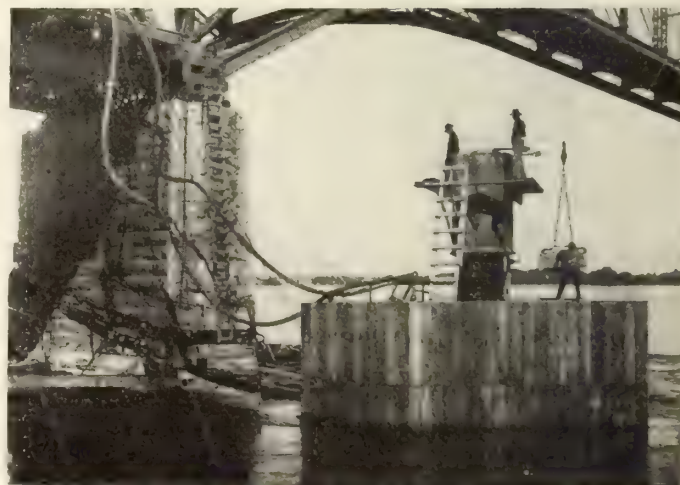
Mud Lake Bridge

Fig. 5 gives the elevation of the bridge over Mud Lake, near Perth, Ontario. It also shows the depth of water, the depth to rock and the nature of the material on the site overlying the rock. The conditions on this site are rather unique in many ways. At the site of pier No. 2 (Fig. 6) the water is about 8 feet in depth, but for the next 50 feet the material is a liquid clay. Below this liquid clay is encountered a stratum of stiff clay to a depth of 12 feet, under this is a stratum of boulders, sand and clay, which is very firm and compact and below this stratum, and overlying the rock to a depth of about 10 feet, is a stratum of cemented sand, rock being encountered at the site of this pier at a depth of from 108 to 115 feet.

It is quite obvious that a spread footing design foundation would not support the load. A pile type of construction would be inadvisable on account of the great depth of liquid mud which would not give the piles lateral stability, the small amount of penetration which the piles would obtain in the stiffer underlying stratum of clay, and the probability that the piles could only be driven to the stratum of boulders and no further. The constant vibration and the stresses due to traction would so affect the foundation that the lateral stresses could not be resisted by the upper portion of piles in the liquid clay, and the working or slight movement which the vibration would cause in the foundation would soon affect the soil adjoining the piles in the stiff clay stratum and cause it to soften.

In the liquid clay mass encountered on this site there is no assurance that the whole mass is not following some progressive movement, which might be slight but in years to come might move any structure which did not receive its support from some underlying fixed surface which would preclude the possibility of movement. The pier should be so designed that in case of a movement of this nature it would be strong enough to resist it and to permit the material to flow around it. For this reason it was deemed inadvisable to place the foundations of this structure on any substance other than a material equivalent to hardpan, or, if possible, on rock.

An open caisson type could be carried to the stiff clays, but this type is impracticable in stiff clays at this depth on account of the great troubles encountered in dredging and removing it. The boulder stratum below this stiff clay was not deemed of sufficient sta-



St. Lawrence River bridge. Sinking pneumatic caisson at pier 14. Note the rigging around the old pier for launching caisson.

bility for the support of this pier, and it would not be economical to remove this nature of material by an open dredging method. It was also deemed advisable to carry the pier some distance into the cemented sand, so as to be certain of obtaining a uniformly hard surface before placing concrete. It would be impracticable at this depth to do this by an open method. For these reasons it was finally decided to construct an open dredging pier and carry it into the stiff clay stratum, at which elevation the dredging caisson was converted into pneumatic caisson and carried through the stiff clay and boulder stratum into the cemented sand until a uniform surface was reached and properly prepared. To add greater stability to the pier the bottom was belled or carried out a distance of 18 inches beyond the perimeter of the caisson, and the whole lower portion concreted to form the base to support the pier. The excavation was carried to a depth of 103 feet 8 inches, which is the deepest bridge pier in Canada, and, with the exception of one, the deepest in America.

The contract for this work was awarded on December 28th, 1912, with the proviso that it should be completed by July 15th, 1913. On account of the delay in obtaining suitable materials before April 1st, active construction was not commenced before this date, and the bridge was completed ready for the superstructure on August 10th, 1913, or in four and a half months' time.

In conclusion, it is quite evident that the pneumatic method, although the most expensive one in the general classification of foundations, is the most economical, considering the conditions which were encountered in the above examples, and brings out clearly the certainty of securing a suitable footing beyond any doubt, the speed of completion and the positive manner in which difficulties can be overcome.

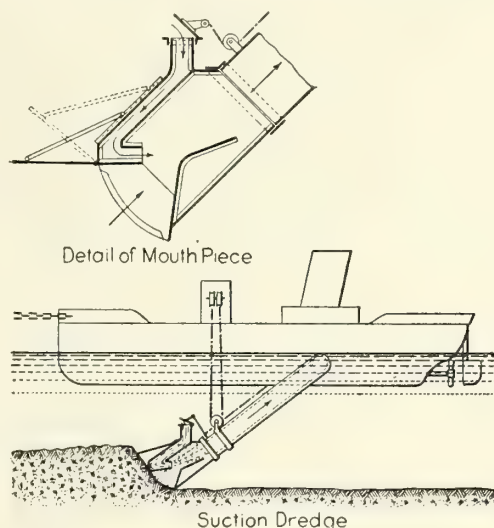
Municipal Sliding

CANADIAN people, says The Surveyor, of London, Eng., are eminently practical. Among their latest accomplishments is the provision of municipal skating rinks and toboggan slides. Vast possibilities are opened up by their introduction. Sliding and backsliding may now be indulged in by both councillors and officials, and an occasional cropper, while entailing possibly some momentarily loss of dignity, will have no injurious effect upon the moral reputation. That elusive member of committee who, blowing hot and cold in the same breath and hunting with hare and hounds, blows cool and steers a midway course when the Press are in the room, may now disport himself at will, turning and twisting and cutting intricate figures to his heart's content. Treading on thin ice will necessarily be avoided with care, although valour may occasionally outrun discretion when the surveyor is being harried into a dangerous corner by a municipal pack in full cry. Tobogganing, too, will have its attractions. On a sled of sufficient capacity the whole council will be enabled to slide in manner both unanimous and dignified, although, a team of horses would have to be employed for a similarly qualified backsliding. An official of evil disposition could possibly cajole his council to enterprise in a leaky toboggan fitted to a water-chute, his trouble being well repaid by the final splash. The switchback toboggan would specially commend itself as typical of public office, with its ups and downs (the downs preponderating), its joyous

mountings to the empyrean followed speedily by its fearful descents to Avernus, its unexpected turns, its gradual slowing down, and its ultimate and complete stagnation. Certainly there is more in the idea than meets the eye at first sight.

Mouthpiece for Suction Dredges

A new type of suction-dredge mouthpiece without any rotating element has been patented in Germany by Herr Pieter von Wienen, of Hamburg. It has the shape of a square box, as shown in the accompanying drawing. Above the lower side is a bent plate forming a dam across the opening. In line with the back slope of this plate and above it is placed the inclined intake for water, this arrangement providing an efficient means for breaking up the dirt and giving a good mix. The amount of water is regulated from the



Mouthpiece for suction dredge.

dredge by a chain operating a flap valve at the pipe intake. An adjustable shield in the front of the box, supported on three struts running in guides and held in place by screws, serves to guide the material to the opening of the mouthpiece.

The mineral production for 1913 in the Province of Quebec is the highest yet recorded, as we learn from a statement just issued by Mr. T. C. Dennis, Superintendent of Mines. This report shows that the value of the products of the mineral industry of the province last year totalled \$12,918,109. From the table of production which accompanies the statement we find that in the output of structural minerals the value of brick product was \$1,272,092, cement \$3,361,292, granite \$482,338, marble \$120,541, lime \$452,330, limestone \$1,570,455, sand \$343,750, sandstone \$5,072, slate \$5,286, tile, drain and sewer pipe, pottery, etc., \$326,165. Notwithstanding the general depression which prevailed during the year it is gratifying to note that the production of structural materials more than held its own, as compared with 1912.

A new pier under plan in San Francisco harbor will be supported on concrete piles 22 in. in diameter, with a mushroom base. It is planned to jet these piles into the sand to a depth of 20 ft. A reinforced concrete superstructure will be used.

Progress, Design and Construction of the New Welland Canal

Great National Engineering Work Involving the Expenditure of \$50,000,000—Comparisons with Old and Existing Waterways

(Staff article)

PROGRESS in the construction of the new Welland Ship Canal, an undertaking which for magnitude and cost will rank as one of the great engineering achievements of the twentieth century, has been a gratifying feature of the work from its inception to the present time. Excavation was commenced in the fall of last year and it is expected that all the contracts will be under way early in the summer of 1914. The proposed canal is the third inland waterway to be constructed so as to form a connecting link between Lake Ontario and Lake Erie. The original Welland Canal is one of the oldest in Canada, having been commenced in the early part of the last century. As originally built it connected Port Colborne and Port Dalhousie, but the difficulties of excavation at a point known as the Deep Cut through the divide in the centre of the peninsula prohibited the use of the Welland River or Lake Erie as a source of water-supply. A summit level fed by a feeder twenty-seven miles long, extending from the Grand River which lies to the west of Port Colborne, was therefore required. Later, however, the Deep Cut was made and the water-supply taken from Lake Erie, which was and is the summit level of the canal. The lake level is somewhat higher than the Welland River across which the canal is carried in an aqueduct.

Canal Development

The possibilities of development of inland waterways traffic do not appear to have been realized at the time of the building of the original Welland Canal which was commenced in 1824 and completed some nine years afterwards. As this canal had locks of wood only 100 ft. long and 22 ft. wide, the natural expansion brought about by increasing development soon necessitated a more extensive canal scheme. So in 1841 this found expression in the enlargement of the waterway by the construction of new masonry locks with entrance locks at Port Colborne and Port Dalhousie. These locks were 200 ft. long and 45 ft. wide, with 9 feet of water on the sills. A further deepening to 10 ft.

was carried out in 1860 and the bottom width of the canal was increased to about 26 ft. In 1875 a further enlargement of the canal was undertaken. The old location between Allanburg and Port Colborne, a distance of fifteen miles, was maintained, the canal prism being widened and deepened to accommodate the new size. A new location was selected between Allanburg and Port Dalhousie, a distance of $11\frac{3}{4}$ miles, for a still further enlargement to the eastward and northward of the old canal, the course of which together with that of the present canal is shown in Fig. 1. The locks on this enlarged waterway are 45 ft. wide at the level of the lower reach and 270 ft. in length between hollow quoins, with 14 ft. of water over the sills. The original Welland Canal is still in existence and is utilized chiefly as a power generator.

The original and present canals followed a route from Port Colborne across the Niagara Peninsula, running almost parallel at the northern end, entering Lake Ontario at Port Dalhousie.

Features of Proposed Waterway

The route followed by the canal now in course of construction is from Lake Erie to Welland, with the exception of a small cut-off about three miles from Lake Erie, and through Welland to the point where the present canal leaves the Welland River. The new canal takes its alignment in the bed of the Welland River, from whence to Allanburg the alignment is the same as in both the old and the present canals. From Allanburg to Lake Ontario an entirely new cutting is made on a much better alignment than the present one, which crosses twice, Lake Ontario being reached about three miles east of the present harbor at Port Dalhousie.

From lake to lake the total length of the proposed canal is twenty-five miles, so that it is shorter than the present waterway which is $26\frac{3}{4}$ miles long. The present canal was commenced in 1872 and completed in 1887, the route at the northerly end being changed slightly to the east near St. Catharines, the canal coming out into Lake Ontario at the same point as the original one. A difference in level between the two

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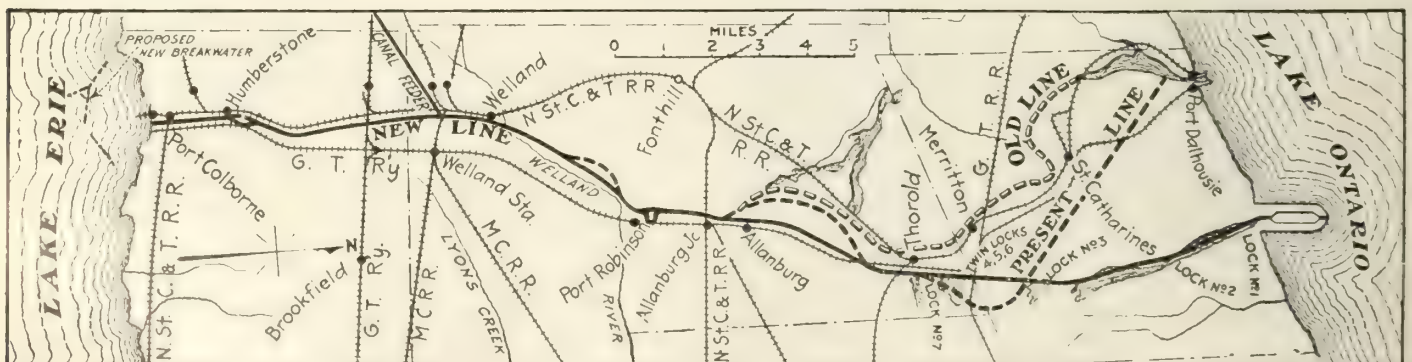


Fig. 1.—The new Welland Ship Canal, showing its course in relation to old and existing canals. The new waterway will be 25 miles long and will be equipped with seven lift locks, each 800 ft. in length and $46\frac{1}{2}$ ft. lift.

lakes of 325½ ft. at low water will be overcome in the construction of the proposed canal by seven lift-locks each having a lift of 46½ ft. The summit level from Lake Erie to a point south of Thorold fluctuates with Lake Erie with an average elevation of 573. From Thorold to Port Dalhousie it drops 327 ft. in 25 locks from the Niagara escarpment to the level of Lake Ontario. The summit level to the elevation of extreme low water in Lake Erie will be controlled by a guard lock and weir at Humberstone, which will overcome the lift between the summit level and any higher water in the lake.

The locks will each be 800 ft. long by 80 ft. wide in the clear, with 30 ft. of water over the sills at low stages of the lakes. The original canal contained 27 locks, of which 24 were 150 ft. by 26½ ft., the remaining three being 200, 230 and 270 ft. by 45 ft. respectively. The present canal possesses 26 locks each 270 ft. by 45 ft., with a depth of 15 ft. over the sills. The width of the proposed canal at the bottom will be 200 ft., and all structures are to be sunk to a depth of 30 ft. in order that the canal may be deepened at a future

Welland River it is proposed to raise the level of the river to that of the summit level of the canal by means of a dam across the river at Port Robinson. This dam will be provided with a large overflow and regulating weir which will control the elevation of the summit level, allowing any surplus water to overflow into the old Welland River and pass out into the Niagara River at Chippewa as at present. In order to keep the river clean it is intended to allow a sufficient quantity of water to run in a continual flow.

The present aqueduct at Welland, also the bank between the canal and the river, will be dredged out. This latter waterway will be used between Welland and Port Robinson instead of the present canal, it being somewhat straighter and requiring considerably less excavating. At Port Robinson a cut will be made through the present bank between the canal and the river through which vessels will again enter the canal prism. It is anticipated that the raising of the Welland River above Welland will cause to be flooded some 1,600 acres of low land adjoining the river bed. This land however is partially submerged every spring by

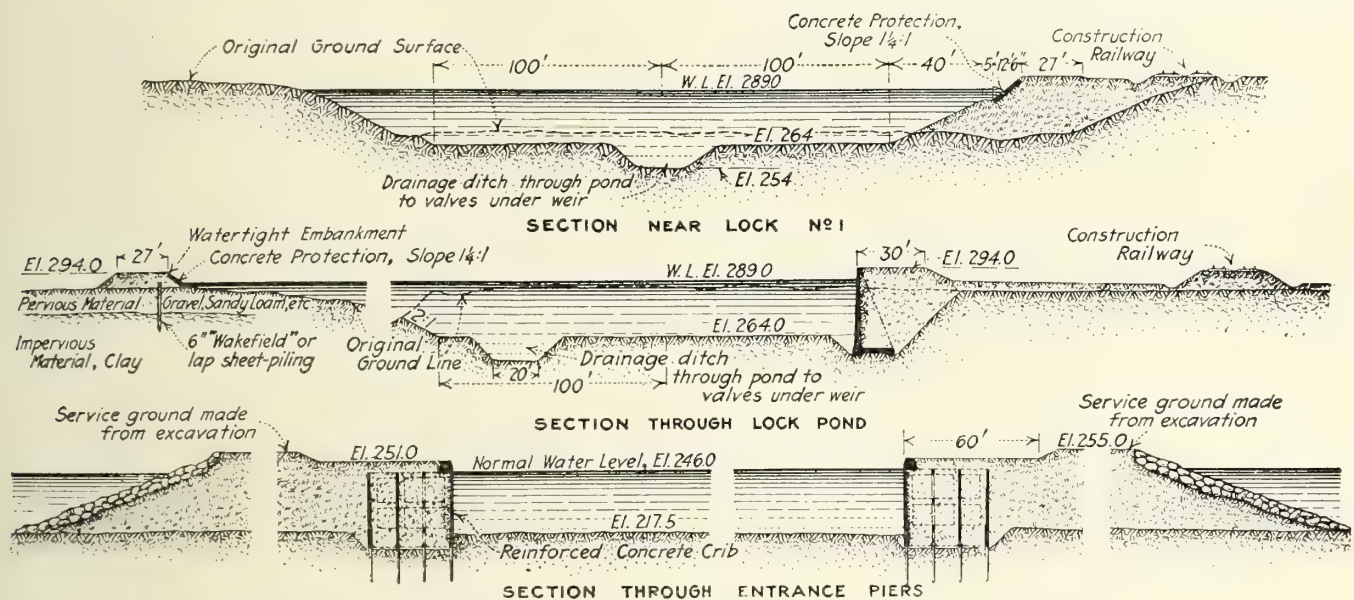


Fig. 2.—Typical sections through Welland Ship Canal, near Lake Ontario.*

date by dredging out the reaches. Drawing A in Fig. 2 shows a typical section of the canal.

The inner harbor at Port Colborne will be deepened to a depth of 25 ft., and the old locks and regulating weir now in the centre of the village will be completely removed. The rock-cut from Port Colborne to Humberstone will be deepened and widened on the west side below Humberstone. A cut will be made across the point now forming Ramey's Bend so as materially to straighten the canal. The excavation from this cut will be rock for the greater part and will be utilized in the construction of the breakwater. A guard lock will be built in the rock-cutting a short distance below Humberstone, and when this new cut is ready for navigation a regulating weir will be built across the abandoned portion of the present canal which will be utilized as a bypass to furnish water to the canal. This lock and regulating weir will control the elevation to the summit level of the canal, which it is proposed to keep at the level of extreme low water in Lake Erie (568 ft. above sea level). The canal will be deepened and widened from Ramey's Bend to Welland by excavating a strip along the western bank. As an alternative to constructing a new waterway over the

the flood water in the river and is used mainly for pasturage. To obviate damage to that section of land in the vicinity of Wainfleet township, which is also low lying, it will be necessary to open up most of the ditches from the point of their present entrance to the river to the intended high-water mark.

What is known as the Deep Cut (deepest cutting 66 ft.) between Port Robinson and Allanburg will be deepened and widened by cutting a slice off the western bank. Allanburg is now the junction of the present and original Welland Canals, and the water required for the latter, which is quite considerable on account of the many power developments within its area, is taken into the canal through a weir at this point.

In the canal scheme now under way it is proposed to close the present old canal entirely between Allanburg and Marlatt's Bridge near Thorold, first building a new weir at the head of lock No. 25 of the present canal to supply the above mentioned water. A dam will then be thrown across the old canal at Allanburg, and the old bed of the canal between the dam and Marlatt's Bridge will be utilized as a dumping ground for the material removed in the widening of the Deep Cut. A convenient dumping ground will thus be formed,

and besides the old canal will become more self-contained, as at present the entrance works are located at an inconvenient distance from the remainder of the canal.

From lock No. 4 the future canal crosses the meadow to the north, following in part the bed of the Ten-Mile Creek until it crosses the present canal at the foot of lock No. 11, at an elevation of 382 ft. above sea level, which is the level of the present canal at that point. This will enable small vessels to utilize the Port Dalhousie entrance as at present, as far as lock No. 11. Below lock No. 3 a heavy cutting is required through the village of Homer to the bed of the Ten-Mile Creek. Below Carleton Street, lock No. 2 is located, and the pond at the head of the same lock at an elevation of 335½ ft. above sea level floods about two hundred acres of land in and adjoining the bed of the Ten-Mile Creek. Below lock No. 2 the canal follows the bed of the creek to the lake, lock No. 1 being situated just below the Lake Road, and but a short distance from the entrance to Lake Ontario.

The locks are to be constructed throughout of concrete founded on bedrock. The lock walls will be 82 ft. above the top of the gate sill, and including the necessary foundation work required below this level two of the locks will have walls 100 ft. high. A notable feature of the lock gates is that they are of the single-leaf type. They will be constructed so as to swing on a hinge at one side of the lock, resting in a notch cut in the opposite wall. The gate at the foot of each lock will have a height of 83 ft., a length of 90 ft. and a weight of about 1,125 tons. The valves and culverts, as designed, will allow the lock to be filled in less than eight minutes, which in these days of rapid transit will be a valuable commercial asset to the new waterway, reducing as it will the time of passage very materially below that required in the present canal system. In order to give them a traffic capacity equal to the other single locks, Nos. 4, 5, and 6 locks are built in twin flights, one for up-bound and the other for down-bound traffic. A pond is provided at the head of the flight, and at the head of each of the single lift locks each pond is utilized as a regulating basin from which water to fill the lock is to be drawn. This method of drawing water from a side pond instead of directly from the canal obviates the formation of objectionable currents and surges in the canal and locks and is the method adopted for filling each of the locks. Lock No. 1, a sketch of which appears in Fig. 3, is in general typical of the other locks. The chief features to be noted in it are the regulating channel to the side of the main lock with its two weirs (regulating weir at the head and west weir) dividing the total fall; the single-leaf gates; the chain guards or fenders above and below the gates; the culvert connections between pond and lock and the concrete bridge, with draw-span, across the lock.

Lock No. 4, which is founded on shale, is built with gravity section walls, whereas locks Nos. 5 and 6 being in a good quality of sand-stone are designed with a five-foot concrete facing to the rock to form the lock chambers. This method prohibits the use of side culverts, so bottom culverts have been used in these two lock systems.

Commencing at the south of the canal the first lift lock is lock No. 7 situated at the north end of the Erie level. A pair of twin guard gates are located here near the southerly limits of the town of Thorold as a special

protection to the summit level. These gates are a short distance south of lock No. 7, the head of this lock being directly opposite the head of lock No. 24 of the present canal. A regulating basin will be formed of that portion of the present canal between locks Nos. 25 and 24 together with a pond of some 27 acres created by flooding the upper valley of Ten-Mile Creek. Below lock No. 7 is a short reach of canal with an adjacent side pond having a surface area of about 84 acres, and immediately below twin locks Nos. 6, 5, and 4 in flight are located. These three locks overcome a descent of 139½ ft. One flight will be used for down-bound vessels and the adjoining flight for up-bound, the total flight being regulated to minimize long delays in the passage of vessels through the canal.

The location of lock No. 3 is directly north of the present canal and at its head to the east side is situated the equalizing basin, a pond of 150 acres. Some difficulty was experienced in finding a location for this lock on account of insufficiency of rock for foundations, but eventually a suitable foundation was located at the present site. The pond at the head of lock No. 1 covers an area of 107 acres with a section through it, as shown at the bottom of Fig. 2. On the left is the regular slope and on the right a reinforced-concrete retaining wall fill.

Not the least notable feature from an engineering point of view is the new western breakwater consisting of a gigantic rubble mound of stone from the excavation north of Port Colborne, terminating in a timber and concrete head-block located some 2,000 ft. further out in the lake than the present breakwater. The object in building this is to ensure quiet water in Port Colborne harbor during storms.

At Port Colborne the outer harbor is at present 22 ft. deep at normal stages of the lake. The deepening of this portion of the harbor will therefore be left for a few years until the connecting channels of the Great Lakes admit of deeper navigation. The inner harbor of Port Colborne will be deepened to the proposed new depth and the old locks and regulating weir now in the centre of the village will be removed.

The outer entrance piers in Lake Ontario at the north end of the canal are placed about 1½ miles from shore where the depth of water is 30 ft. From these piers to lock No. 1 a wide channel will be dredged. The sides of this channel will be protected at the outer and shore ends by reinforced-concrete cribs (as shown in Fig. 2), with concrete superstructures along which vessels may lie. These cribs will be built on shore, launched and towed into position. The wooden false bottoms, which are held temporarily by an arrangement of struts and wedges, will be removed by a pull on the chain after the crib is sunk, and the cribs will be subsequently filled with spoil. An embankment built about 500 ft. wide will be formed on either side of the channel from material excavated from the canal between the lake and Thorold. This embankment will extend from the shore line of the lake to the outer entrance piers.

The Welland division of the Grand Trunk Railway is situated at a point where the new twin locks are to be built. It will be necessary therefore to divert the line some distance to the west. The diverted line will bear the same relation to the future canal as the present line does to the existing canal. At whatever points road or railway crossings over the canal are required, bascule lift bridges will be constructed except in two cases, where the roadway is carried on the

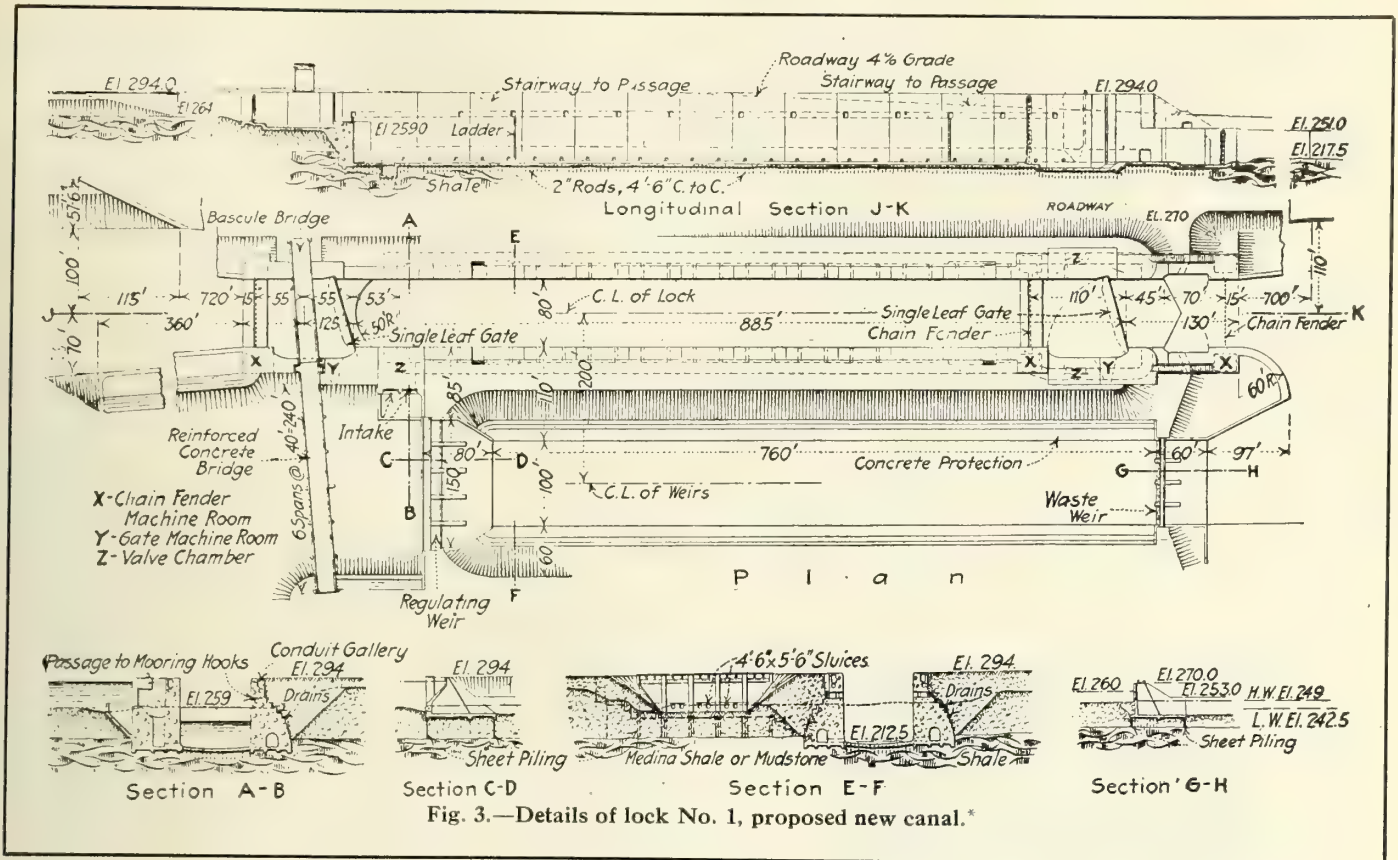


Fig. 3.—Details of lock No. 1, proposed new canal.*

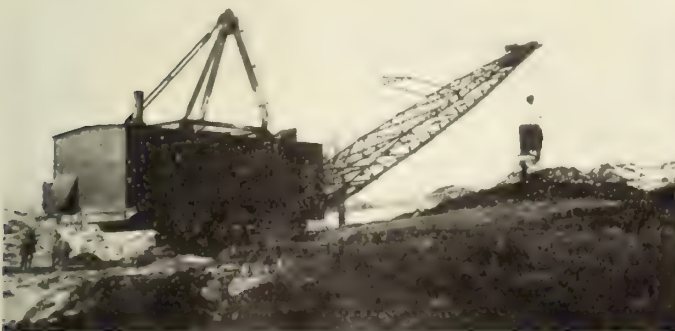
single-leaf lock gates. Where possible crossings are located over the head or foot of the locks to shorten the length of the bridge.

Details of Excavations

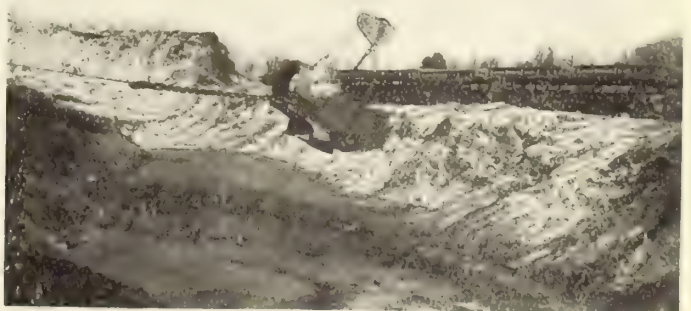
The contract work has been divided up into nine sections, of which four have been contracted for up to the present. The remaining five will be let early in the summer. Section 1, covering the Lake Ontario entrance at Port Weller, and including lock 1, was let last summer to the Dominion Dredging Company, Limited, at \$3,500,000. The contract is well under way, a considerable quantity of excavation work having already been accomplished by the firm. They have four dredges at Port Dalhousie in readiness to go on with the work in the spring. For some time past two steam shovels of the 85-ton Bucyrus type and one Class 24 Bucyrus dragline excavator with 3½ yd. dipper and 100 ft. boom, have been at work. The ex-

cavated material is being placed in the lake to form the dykes which will enclose the new harbor. The contractors have also been excavating in the canal prism and for the construction of the railway which is to be built along the west side of the canal from Port Weller to Merritton. The company are also using a No. 73 Marion-Osgood steam shovel. They have seven locomotives and about 50 air-dump cars of 12 cu. yd. capacity, as well as a number of travelling cranes and spreaders on the section, operations having proceeded with practically no interruption throughout the winter. This section consists of 1½ miles of the entrance channel and about 1½ miles of dry excavation work, including the construction of lock No. 1. The entrance channel will be dredged to the required depth. Such is the character of this section of the work that very little rock will be encountered.

Section No. 2 was awarded to Messrs. Baldry, Yerburch & Hutchinson, St. Catharines, on October 23, the



Excavator in dumping position.



Closer view of bucket and drag-line at work.

VIEWS OF BUCYRUS DRAG-LINE EXCAVATOR AT WORK ON SECTION 1.

contract price being \$5,500,000. The work extends a distance of about 4 1-3 miles, commencing at the south end of section 1, and including locks Nos. 2 and 3. The work will be practically all earth excavation to the extent of about 6,500,000 cu. yds. Sub-contractors Messrs. Yale & Reagan, of Chicago, have commenced work on the section, their plant comprising one 70-ton Bucyrus steam shovel and a Bucyrus drag-line excavator. At the upper end of section No. 2 sub-contractors the Hill-Leonard Engineering and Construction Company of Toronto, have started operations with a Marion steam shovel. This firm are also putting in another Model 75 Marion shovel. On the same section another sub-contractor, Mr. Joseph Battle, of Thorold, has driven the foundation piles and fender piles for the construction of the railway swing bridge which is to be built across the present canal at a point below lock No. 11. The concrete superstructure is at present being built, and the Hamilton Bridge Company, which has the contract for the steel superstructure of the bridge, will begin operations in a few weeks. Messrs. Baldry, Yerburg & Hutchinson will shortly have a Class 24



Mr. J. L. Weller, M. Can. Soc. C.E., engineer-in-charge, new Welland ship canal. Mr. Weller has had considerable experience of engineering work on Canadian canal systems, having been superintending engineer of the present canal prior to undertaking the new work.

Bucyrus drag-line and an 85C Bucyrus shovel in operation.

Section No. 3, the contractors for which are Messrs. O'Brien & Doheny, and Quinlan & Robertson (Confederation Construction Company, Montreal), is the largest contract on the work, and is the pivot in many respects of the whole undertaking. Although confined within the smallest limits. It is just under two miles long, and passes through Thorold. The twin locks in flights 4, 5 and 6 are in this section, also the single lock in No. 7. The contract was let on October 3, the contract price aggregating about \$10,220,665. Such has been the progress on the work that about 30,000 yds. of rock and about 3,000,000 yds. of earth excavation have been removed. The contractors have six steam shovels of the Marion type, which carry a 2½ yd. dipper, and have a daily working capacity of from 1,000 to 3,000 cu. yds. The Welland division of the Grand Trunk Railway, east of the town of Thorold,

intercepts the course of the proposed canal, therefore it will have to be removed. For this purpose the contractors have six steam shovels of the Marion type at work excavating earth, and a small 20-ton Marion steam shovel excavating rock for its diversion. They are also installing a Model 261 Marion drag line machine, which handles a 5 cu. yd. drag line bucket with a 100 ft. boom. A double-track steel bridge, to be used as a temporary diversion of the main line of the Grand Trunk Railway east of Merritton, will be constructed, and at present a pit 80 feet in depth is in course of excavation through earth and rock to accommodate one of the piers of the structure. This diversion will be in use for three or four years until the locks are constructed. The earth in course of excavation by the steam shovels is being dumped on either side of the large dam to be built at the head of lock No. 6, the material to be afterwards re-handled, watered and rolled to make it watertight for the formation of the embankment at both sides of the entrance channel. At its highest point this dam will be about 75 ft. high and will hold back a basin containing about 84 acres of water. The contractors for this section are required to furnish contractors of sections 1 and 2 with all the rock required on their sections, as well as on section 3.

Section 5, the contract for which was let to the Canadian Dredging Company last November at about \$2,000,000, extends from Allanburg to Port Robinson, is just under two miles in length. This follows the route of the existing canal, therefore the work consists mainly of deepening and widening. Mr. James Corbett, sub-contractor, is getting in his steam shovel plant consisting of five Marion steam shovels to excavate in the neighborhood of 2,500,000 cu. yds. of earth.

Section 8, which cuts out Ramey's Bend, is the next section which will be placed in the contractor's hands. Section 4 is an entirely new cutting, and with sections 6, 7, 8, and 9 will be let and under way early in the summer. The time limit for the completion of section 5 is April 1, 1918; that for the other sections is April 1, 1917.

All the Bucyrus shovels and drag-lines in operation on the works were sold by Mussels Limited, of Montreal and Toronto.

As an engineering undertaking the future Welland Canal will bear favorable comparison with the Panama waterway in many respects. The great lock gate at the foot of each lock, for example, will be larger than that of the Panama, being 90 ft. long and 83 ft. high.

The Canal will cost approximately \$50,000,000, and will take at least five years to complete.

The construction of the new Ship Canal is under the direction of the Department of Railways and Canals. Mr. J. L. Weller, M. Can. Soc. C. E., who has had considerable experience of Canadian Canal systems, is the engineer-in-charge of the entire work. Mr. F. E. Sterns, who is Mr. Weller's designing engineer, was for several years engaged in engineering work on the Panama Canal.

The resident engineers connected with the work at present include:—Mr. C. L. Hays (section 1); Mr. E. G. Cameron (section 2); Mr. H. M. Balfour (section 3); Mr. J. J. Aldred (section 5); Mr. E. P. Johnson (sections 8 and 9).

Of 16,600,000 h.p. available in Canada for the development of hydro-electric power, but 1,016,521 has been harnessed.

Requirements and Scope of the Consulting Engineer in Waterworks Practice

CONSTITUTING a general discussion of the life and work of the consulting engineer, an article under the above heading, written by Mr. John W. Alvord, consulting engineer, Chicago, and published in a recent issue of *Engineering and Contracting*, cannot fail to be received with great interest by the engineering profession in Canada. The abstract given below will doubtless be found particularly instructive by those entrusted with the management of local water supply systems. In its broader application it will appeal to all who entertain or who have ever entertained the idea of going into consulting engineering practice.

Requirements of the Consulting Engineer

In the first place, the consulting engineer must have an investigating type of mind. That is, a type of mind that can accumulate evidence, sum up facts, and procure information without coming to premature decisions. This is not the common type of mind, and usually has to be cultivated. Most of us naturally jump at conclusions, and the less we know about a subject often the more hastily we conclude on something about it.

In the second place, the consulting engineer must subordinate the desire for personal gain to the pursuit of truth for its own sake—he must be willing to face a personal financial loss if he should become inadvertently so involved that it is necessary, to do so, rather than produce inefficient results, or deliver undigested opinion. If he undertakes a problem at all, he will be expected to serve his client's interest in the light of truth and fact even if that involves a personal contest with his own client and a financial loss to himself. In other words, no man who has not a high sense of honor, a keen appreciation of principles for their own sake, and a disregard for emolument, when emolument interferes with principles, can hope to succeed, or at least succeed very long as a consulting engineer.

In the third place, a consulting engineer should have a broad experience behind him upon which to base his work. The investing public instinctively distrusts youth. The old saw, "Young men for war, old men for counsel" does not seem to lose its force as an axiom. The investigator usually demands that the man upon whose judgment he stakes his money shall have arrived at years of discretion, and in the long run this is founded on good common sense. It is a disappointment to the young man who, with his ambition and vigor, would like to leap at once into the final fruits of a long career, but there can be no better and sounder foundation laid for the work of the consulting engineer than 15 or 20 years' experience in the superintendence, construction, and design of engineering works—in subordinate position if need be—with all the experience in human nature, and the opportunities for self-improvement that that length of salaried service implies.

In the fourth place, a consulting engineer must of necessity have some capital and business experience to successfully operate in his calling. To enter the consulting field with insufficient means is not only to be daily harassed by business anxieties, but is often a fatal handicap to the engineering judgment in matters where the engineering judgment should be carefully protected against baneful influences of a financial character. There is probably no more peculiar and sensitive strain upon the morals than is afforded by the financial temptations of an insidious nature that con-

front the young and inexperienced engineer who has too early embarked on an independent career. The temptation to slight his work when he has named too low a fee—the temptation to accept work from a client who clearly wants to use him improperly, or the temptation to report favorably on a doubtful project because it may lead to more work—in these and a thousand other insidious ways are embarrassments created for the financially helpless, which do not so often come to the old-established and well-founded practitioner.

Ordinarily it takes a considerable amount of capital to start the practice of a consulting engineer. The less wide one's acquaintances and the less mature one's experience, the more capital it takes to provide for the cost of "Going Value," that is to say the cost of financing one's experience and personality onto a paying basis in the engineering field.

Not only does it take capital to start such a practice but it requires a considerable capital to conduct it. While it is a safe business, in that accounts are almost always good and collectible, collections are not always possible until work is done. It is safe to say that the foremost consulting water works engineers in this country require a working capital always invested in their business of not less than \$10,000 to \$25,000, and perhaps at times of even more.

In the fifth place, the consulting engineer must expect to do many things for the public and for the advancement of his profession without any direct remuneration, not that he should do work that can and ought properly to be paid for, but many times it is desirable for him to make original investigations costing sometimes many thousands of dollars, the results of which it is wise for him to give to the public and to his professional brethren. In the matter of information the biblical injunction "freely we have received freely give" is as good an axiom in engineering as it is applied to the religious life. No successful consulting engineer ever made his mark by hoarding expensive information. Very few consulting engineers have patented their ideas extensively and remained consulting engineers. The professional world expects and demands of the consulting engineer that he be generous with his surplus time and means, and they accord honor and reputation only to those who live up to their opportunities in this regard.

In the sixth place, the consulting engineer must have the acquaintance and the long personal confidence of men of affairs who have need for his services from time to time. This is really his first and fundamental requirement but it is necessarily the result of all that has been heretofore outlined.

The work of the consulting engineer is based primarily on the personal conviction of this acquaintances after many years of observation that he can be of real use to them in difficult problems. After years of established reputation, others may come to him on the basis of his reputation alone, but in the start he must depend on this element of personal confidence. The best advertisement a consulting engineer can have is a satisfied client.

In municipal work and municipal water works work particularly, the consulting engineer labors under the handicap that rotation in municipal office often deprives him of influential friends whose confidence he has established by his work for their city in the past.

The consulting engineer is peculiarly dependent for his reputation on the fellow members of his own profession. Nobody knows so well how efficient or deficient an engineer is in any given line, as do this professional brethren. If you

want to be sure to get a good doctor, inquire about the one you have in mind among other doctors in his vicinity and you will generally get a line on him. So it is with engineers, to select the right engineer for a particular problem the searcher for talent can do no better than to advise with other engineers in kindred lines. Nobody knows engineers like engineers, and an engineer who stands well with the rest of the engineering profession, and is recommended by them, may usually be safely employed.

So far we have spoken about engineers as a class. The water supplies of our several thousand cities in this country in connection with their sanitary and other municipal problems, afford, perhaps, the largest field for consulting engineering that obtains among engineering specialists. This is because water supply and sanitary problems are sporadic. In railroad work, railroad operative problems are constantly arising and are generally local to the road, consequently railroads have to continuously employ engineers expert in their work. As a result there are few independently practicing consulting railroad engineers available. In bridge and structural work, there are a larger number available but it is safe to say that at least half of the consulting engineers in this country are occupied almost solely with municipal problems, which are many and varied.

Field of Usefulness

The consulting engineer in water works practice has the opportunity to make himself useful in special ways that perhaps should be noticed in some detail.

In the first place, he is, or should be, familiar with all of the more important water supplies of the country, so as to understand in a general way their peculiar working conditions and special characteristics. In addition to a general familiarity with such plants, he should have a detailed knowledge of a large number of plants with which he has personally been identified and from which he has drawn his experience. It is quite as important that he have a good working knowledge of small plants as of large plants, for as a rule, more skill and care is required to adapt means to an end in small water plants than in large ones, besides which, one must realize that only a good perspective can be obtained when one has in mind measures which are applicable to all sizes and varieties of works.

In the second place, he should desirably have close and intimate touch with water works men and interests all over the country. He should have a specialized library of all the water works literature, carefully filed and indexed, for ready reference. He should also have the notes of his own past work so indexed and accessible that they are almost instantly available. And if he be wise he should expend a good deal of time and money in tabulating data forming a data file for ready reference on all of the more independent subjects that are likely to come before him.

A library of special water works reports by other engineers, chemists and experts, should form a most valuable part of his library, and this cannot ordinarily be accumulated without special watchfulness through the professional courtesy of his fellow practitioners, covering a considerable period of time. A well-equipped, modern, up-to-date library in a water works engineer's office represents an investment, with its accompanying files, of from \$3,000 to \$15,000.

In the third place, if he is to be of the greatest good to the greatest number of clients, he must have a well organized force of assistants, familiar with his methods and ideas, and capable of carrying them out, oftentimes at a distance from the home office. Engineering assistants of the proper type of mind needed by the consulting engineer must be trained in his own office by a well arranged system of precedence, promotion, and personal interest and instruction. With such a force the personal influence of the chief of the office can

be spread out over a very large field without making the cost in any one investigation unduly expensive, because in a well organized office no man should have to do what a less expensive man can do equally well, and the chief of the office can confine and limit his time to those things only which are required for direction and general supervision to the financial advantage of his client.

In the fourth place, the water works engineer must continue to be a close student of the art all of his professional life. So soon as he begins to relax his attention in this direction, so soon does he begin to drop back and be in danger of being superseded. No matter how busy he may be, or with what great responsibilities he may be charged, he cannot afford for one instant to relax his study time. New methods must be investigated where they have promise. Water works literature should all pass under his eye, at least to the extent that he catches the meaning and purport of every important water works article, paper, or book that is presented during the current year. The water works conventions in which he is interested must be attended, and he must see to it that he is constantly rubbing up against men and minds and keeping up with the current of thought in his special line of work. The exacting requirements of this kind of study, in connection with the business of operating an office, pursuing special problems, and at times shouldering the responsibilities of construction, is a severe requirement, and with most men compels much evening work, especially in early life. The social sacrifices which most of the prominent water works engineers of this country have undergone would surprise many a young man who saw only the emoluments and the rewards involved.

In the fifth place, the water works engineer in consulting practice should have breadth of view outside and beyond the strict limit of his own profession. His more especial field is, however, a broad one and may be outlined as follows:

In water source inquiries he must be informed in meterology, hydrography, and storage problems as well as all of the specialized work done in the underground waters. In questions of quality, he must have a general working knowledge of chemistry and bacteriology so as to make correct interpretations, weigh relative advantages and disadvantages of different waters, test those in use, guard the community against disease and epidemic and decide on questions of filtration. In mechanics, he must be well acquainted with all of the various machines, appliances, and fuels, and deal with questions of combustion, station economy and transmission problems, all of which go to the successful solution of hydraulic power equipment and economics. In hydraulics, he must, of course, have a wide knowledge of the various properties of water and its control. In law, he must be proficient with the details of municipal methods and checks, and the relations expressed in contracts. As an administrator, he must know how tactfully to manage men, talk to Boards, Councils, Committees, deal with contractors, and superintendents. In economics, he must know how to reason about finance, understand the conservation of capital, relation of time to cost, and the specific economic questions that always accompany matters of public policy. In matters of public health, he must be fully acquainted with the theories of disease, the etiology of epidemics, and the laws and methods of controlling the sanitary surroundings of the modern community. Now all of this means that to the owners of the water supplies of this country there is available on comparatively short notice in a considerable number all of the means and requirements of an organized force, for the rapid study and solution of the many difficult problems that occur in the art of municipal water supply.

Probably the greatest advantage that occurs to the local water supply management from the engagement of the consulting engineer, lies in the fact that to the solution of local

problems can be brought a very wide range of comparative study with the possibility of improved methods and the application of a variety of means. This comes only through a wide acquaintance with the successful ways in which difficulties are overcome elsewhere. The more water works officials and managers mingle in the water works conventions or visit varied plants in the different parts of the country, the more they realize the value of this broader aspect of their problems, and appreciate the work that the consulting engineer can do for them.

A second valuable office which the consulting water works engineer can perform for the local water works is to bring to its investigation a mind fresh, unbiased, and free from any previous local tradition or precedent; not that local knowledge is not important and valuable and must always be carefully considered, but oftentimes a review of many possible methods are necessary, and such a review often throws certain methods into strong relief that might otherwise be passed by. No one knows better than the consulting engineer himself that logical research among facts, with a correct and unbiased summation, may often reverse a pre-conceived opinion held at the beginning of the investigation.

A third valuable aid which the consulting engineer can give to the local water works management is to give perspective to the problem in hand by shaping up all the alternatives, so that after a series of projects are complete on comparative basis the management can see as clearly as the consulting engineer why a certain course of improvement is desirable and necessary. Indeed, it should be the special aim in all engineering reports to so arrange the data and contrast the opposing courses of action in a series of estimated projects that the desired decision shapes itself almost unconsciously from the facts contained in the report. It is often well in comparative work of this kind to include projects that are not favored for the sake of fairness and to throw into stronger relief a desirable selection.

The consulting engineer therefore, is not a dictator or an autocrat. He is not a wizard or a prophet. He is simply an intelligent human being who has learned how to lay hold of a special problem in a patient and orderly way with the means that are open to any one, and finally dissolve the mists that hang about the difficulty so that the layman can understand the matter as fully as the engineer. All this is accomplished by taking one step at a time, with a reason for every step.

Only the more intelligent of the water works community utilize such services. In a large majority of water works plants the consulting engineer is unknown, or, if known, he is called only rarely to remedy blunders, or a succession of blunders, caused by overconfidence. Particularly is this true in municipal work. The rapid rotation in office of the American municipal official causes him to imagine that he must decide all matters off-hand as best he can, and the idea that many municipal problems are matters for careful and specialized study does not ordinarily appeal to him.

Only as we advance in civilization and better government will we realize that a thought must precede an act, and the more important the act the more necessary it is to have careful preliminary thought.

Strictly speaking, the consulting engineer is one who gives his time wholly to advanced and specialized study. As a practical matter, however, most consulting engineers undertake more or less construction. This is, in the main, desirable as it keeps them in touch with the practical side of their profession and prevents their becoming mere theorists.

Some consulting engineers in water works work limit themselves annually to a few large undertakings in construction, while others will undertake a limited amount of all kinds of construction, both large and small. The latter, of course,

develop a larger working organization than the former, and while a greater variety of practical experience results, probably such engineers have less time for the studious side of their profession. Nearly every consulting water works engineer has some specialty to which he has given more than ordinary thought and attention.

Consulting Engineers' Fees and What They Call For

The fees which water works engineers receive cause them to be regarded ordinarily with some envy by their salaried brethren, but there is also another side of the picture. The better class of well-known consulting engineers ask \$100 per day for their time, \$50 per day is common, and from \$200 to \$250 is not unusual, but such men do not expect to do any work that can be just as well done by a competent assistant, so that the amount of time which they ordinarily charge to a problem is quite limited. Nor can they expect to maintain that rate constantly no matter how busy they may be. The business of their office, their correspondence, time taken for special studies, attendance at conventions, and committee work, make large inroads on their annual schedule, and it is safe to say that the waterworks consulting engineers are one of the most approachable classes of men. They do not expect to earn money all the time. The expenses of a consulting engineer are usually quite large. He must be a member of many technical societies and attend their conventions. Often he is called upon to do elaborate and extensive committee work in this connection. In many ways he finds it desirable to make much independent research. It is safe to say that a consulting water works engineer who has offered him all the work he can attend to, will be unable to properly charge up more than two-thirds of the calendar working days in the year and will often otherwise expend from one-sixth to one-third more of his time for the benefit of his clients, his profession, and his office efficiency.

The work of the consulting engineer calls for a great deal of arduous travel—from 20,000 to 60,000 miles a year for the busy man. It takes a robust constitution to stand all the changes in climate, winter and summer, with all the varied diet and hotel life that continual travel involves. The engineer is usually expected to work from 10 to 16 hours a day when away. Often many nights a week must be spent on a sleeping car, and with anywhere from 100 to 200 days a year away from home, life is not always a joy.

But the work of the consulting engineer unquestionably has its own peculiar rewards, for he is thrown into contact constantly with bright minds. He is constantly confronted with new and interesting problems, and filled with the zest of being needed and useful. Charged with great responsibilities for the public health and welfare, his work is undoubtedly most stimulating and inspiring.

The National Builders' Supply & Enamel Concrete Brick Company, Limited, Montreal, of which Mr. H. C. Harding is managing director, will start their brick plant at Mascouche, P.Q., some time this month. A special train from Montreal will convey a party of Montreal and Toronto architects as well as prominent engineers and contractors from these and other Canadian cities, and the plant will then be officially started.

Mr. E. R. Doe, of Victoria, B.C., who died recently at the early age of 47, was head of the well-known contracting firm of E. R. Doe Bros. With his brother he completed successfully several important engineering contracts for the Canadian Pacific Railway, among which may be mentioned the docks extension some seven years ago, and a large portion of the work on the new terminals on the Songhees Reserve.



Reinforced concrete arch bridge under construction at St. Catharines, Ont. This bridge, which connects the city with a new residential suburb, has 13 spans, 56 ft. centres and a total length (exclusive of approaches) of 700 ft. The width is 30 ft. and the height from water level to roadway 71 ft.

Reinforced Concrete Bridge at St. Catharines, Ont.

BRIDGE construction at St. Catharines, Ont., promises to be an important factor in the extension and development of that city in the next few years. St. Catharines is built more or less in a half-circle, following the valley of the old Welland Canal. Its location is to the north-east and west of the disused waterway, leaving the southern section practically undeveloped. It is to open up this section of the city that a new concrete bridge is being constructed. The main proportions of the new structure are: extreme length, 700 ft.; width, 30 ft.; height, 75 ft. The bridge is constructed of solid concrete throughout, and when completed will have thirteen elliptical arches, each arch having a clear span of 50

The bridge is designed to accommodate both vehicular and pedestrian traffic, and will have a 25-ft. roadway and a 5-ft. sidewalk.

Mr. W. D. Scott, of the city engineer's department, St. Catharines, has charge of the work, which was commenced in October, 1912, by day labor. As will be seen by the photographs here reproduced the bridge is about half completed. The remainder of the work will be done by contract, which is to be let in a few weeks.

In the making of the foundations and the construction of the bridge up to the present, about six thousand barrels of Canadian cement have been put in. The cement was supplied by the Canada Cement Company.



Reinforced concrete bridge under construction at St. Catharines, Ont.

Engineering Topics in the Old Land

Status of Incompetent Engineers Maintained by the Work of the Specialist—Special Training Required for Road Engineers

By our London Correspondent

SPECIALIZATION is year by year rendering the way of the incompetent easier. When buildings were composed of brick, stone, timber, slate and cement, an architect was at least competent to prepare his own plans. The introduction of metal—a material foreign to him—was the first step in the architect's downfall. Even a cast-iron girder, stanchion or storey post was beyond his ken. He was (or prided himself that he was) an artist rather than a constructor, and he did not bestow that care upon his sections that he did upon his elevations. Steel frame construction cast him down pretty considerably, and when reinforced concrete came to the front he sank finally into an abyss of despair, and delegated his work to the engineer. But the engineer, placed in the scales, was found wanting. His knowledge was too diffuse, too general; and it was not until the exigencies of modern building evolved the constructional engineer that really satisfactory work was assured. Manufacturers were quick to realize the possibilities of the constructional engineer as an addition to their staff, and scarcely a firm of repute exists now that has not its department for the assistance of the outside incompetent. In reinforced concrete this is especially the case, and the public would have a shock could it know to what an extent manufacturers and contractors, who afterwards carry out a work, are responsible for its design. It is doubtless better, so far as the safety of the public is concerned, that these expert firms should undertake the responsible work of design than that it should be left to the mere architect; but the system has many grave disadvantages. Among an architect's duties is the superintendence of works as they progress. He is expected to be master of every detail and to be able to detect the least flaw or blemish. How then does he act when the works are foreign to him, when the plans and specifications have been prepared by a specialist firm, and when that very specialist firm is executing the contract? The scandal has become so grave in England that the Local Government Board have had to raise serious objections to many reinforced concrete designs brought forward by municipal engineers, simply because the board saw that the engineers had but an imperfect knowledge of their subject and were relying solely upon the advice given gratis by manufacturers whose fingers were already very deeply imbedded in the pie. It may be argued that municipal engineers are not expected to be, and are not, either architects or constructional engineers; but a fairer way to put it would be to say that unhappily the board have no control over either architects seeking free designs or constructional engineers supplying them. The system hits the specialist engineer very hard, but it is a perfect gold-mine for the incompetent. One of the first duties of the central committee when it is formed (as it is to be hoped it will be some day) should be to obtain legislation prohibiting a man from affixing his name to plans not of his own preparation. Brain (in the engineering profession at least) might then come into its own!

The necessity for special training of road engineers is a subject which is claiming a large amount of attention here. To use one of the most hackneyed phrases of the day "self-propelled traffic has come to stay," and to use yet another, "the advent of the mechanically-propelled vehicle has revolutionized road-making methods." There was a time when highway construction (including necessarily highway bridge construction) formed no unimportant part of the work of the civil engineer. Work of this nature is now almost wholly carried out by the engineers to municipalities or county authorities, and it comes as a shock to find one of the latter advertising for an engineer possessing a qualification whose acquisition demands no experience in road construction and maintenance. "Applicants," ran the advertisement, "must be members or associate members of the Institution of Civil Engineers," and while such qualification may (but not necessarily must) be obtained by examination, the examination may be passed without knowledge of the subject referred to. There is no doubt that the county authority acted in good faith, erring through sheer ignorance; and it is of the highest importance, in the interest of good road administration, that the certificate of the premier institution should be appraised at its true worth. With two institutions holding examinations in municipal engineering (in which road construction and allied matters hold prominence) it is in the last sense ridiculous to compel municipal engineers to hold a qualification which affords no proof of their fitness to undertake the duties entrusted to them. The question is far removed from an insular one, for in more countries than one the "representative" civil engineering body represents every grade of engineer except the municipal. That a municipal engineer should be a civil engineer goes without saying, but civil engineering must form only part of his training, and the whole is greater than the part.

The manufacture of cement in the electric furnace, hitherto made difficult by the formation of calcium carbide that ruins the cement, has been made practicable by the newly-patented process of a Swedish engineer. The method of overcoming the difficulty consists in adding a metallic oxide to reduce the carbide. Iron oxide has proven a suitable material, and, instead of including this in the charge of the furnace, it has been found sufficient to add the powdered oxide to the cement product taken from the furnace.

An employment bureau has been established by the Boston Society of Civil Engineers for the benefit of its membership. The bureau is intended to be a medium for securing positions for its members and applicants for membership and also for furnishing employees to members and others desiring men capable of filling responsible positions. Two lists are kept on file at the society rooms, one for positions available and the other of men available, giving in each case detailed information.

A Practical Discussion of Estimating Methods in Building Work

By Henry A. Hoyt

CONTRACTORS are by necessity estimators. Either they estimate the cost of building construction themselves, or, in the case of larger concerns employ estimators, or "quantity surveyors," as they are known across the water. In either case, the final success of a building contract depends vitally on two results—first, getting a price for it, and second, erecting the said building for the said price, plus the desired margin.

Recently a card has been circulated in building circles bearing a sort of advertisement, and on one side the following: "Contracting, Like Horse Racing, is Due to Different Opinions." Usually the "different opinion" is the direct result of great differences in the method and manner of estimating the cost of construction. It is probably a fact that no two contractors prepare estimates and recapitulations of materials and labor in the same manner. This is not necessary always, but some system or near-system should be employed. Most of us have seen the picture entitled "The Successful Contractor," showing a builder at his desk, deep in thought, hand in his hair, and supposed to be saying, or at least thinking, "What did I forget?" This, unfortunately, is too often true. The writer has seen successful estimates prepared on slips and scraps of paper and used envelopes and the like, but the element of success and certainty involved would have been more secure, and at least more satisfactory had more system been used. It is of secondary importance, the kind of system adopted; in fact, it is just as bad to over-systemize the business of estimating till the system eventually swallows up the business in the deadly overhead expenses. One very well-known general contractor uses large blank books, weighing many pounds, and everything is kept in this book, even to the minor figures used to get off the quantities. It finally resembles a school boy's scratch pad. Another well-known contracting engineer, a man of a vast amount of experience, keeps everything pertaining to one estimate in a heavy, large manila envelope, and these are filed away eventually by name and number. A certain well-known contractor uses a large loose-leaf book, and invariably carries it around the country with him wherever he goes. He became known to several of us as the "black book man." Another contractor once made up his figures in a certain school competition in the lobby of the local hotel, wrote out his bid and walked away, leaving his estimate sheet on the hotel desk. One of his competitors walked off with it and then cut his own estimate. Very foolish and careless of both of them, but it so happened that neither of them got the contract. One contractor on a large public building competition had his bid neatly typewritten on his stationery with a space for the final amount left blank. This he filled in at the desk of a local bank and carefully blotted the amount with a new blotter. Soon another contractor sought out the same place to fill out his bid and learned the amount of the first man's bid from the blotter, mirror, etc. Sounds "fishy," but it's true. All of the foregoing are incidental reminiscent experiences only and show the great diversity of methods employed by builders. Probably

more errors creep into estimates, especially errors of omission, by the use of printed estimate forms. No two buildings are sufficiently alike to permit of this form or blank being a success. Many of the printed items will be used on one building and not on the next, and if you place no figures after an item not involved in the structure in question, you are very liable to omit some figures from some other item of vital importance to your recapitulation. This opinion on the "printed blank" question will be disputed by some good estimators.

Recapitulation of Estimate

When you get a set of plans to bid and estimate from, first make one person responsible for the recapitulation of the estimate. Let that person read the entire specifications through, examining the plans meanwhile carefully and explicitly. Then make up a full and complete tabulation, synopsis or recapitulation, and have it so correct that you can depend on it as final, knowing that when all items are filled in and carried out the estimate will be complete. The correct way to take off the estimate is "as the building would be built." Always remember "order is heaven's first law," and make out your estimate in its regular order. Some make up the estimate alphabetically, but "elevators" and "excavations" are rather far apart in the usual order of building erection. Decide early what portions of the work sub-bids will be asked upon, and even if sub-bids are taken, "take off" the same yourself if you have time and are sufficiently capable. Get several bids on each item asked for if possible. It is hereby respectfully admitted that the ideal method is no sub-bids on anything till after you get the contract signed for the job, but as long as present methods of contracting exist on this coast sub-bids will continue to be invited and used by general contractors as a class. Make mental or written notes of errors or omissions in drawings or specifications, and if serious, take it up at once tactfully with the architect, but do not take up minor discrepancies with him that would make no difference with your estimate. Your time should be worth as much as his, possibly more.

Checking up all quantities and minor figures in an estimate should not be necessary if the work has been well and conscientiously performed. There are many differences of opinion on this item of re-checking one's estimate, but if many jobs are figured it is enough work to estimate once. (One estimates for nothing enough usually.) If the estimate is expected to be re-checked one gets into the serious habit of depending too much upon the said re-checking. The crucial test of a contractor's fitness for his work is his ability to handle men and operations successfully, but second only in importance is his ability to estimate the probable cost of construction. These two qualifications are not usually found in one man, but if so found he should make a successful contractor. Often successful contracting firms consist of two persons—one whose special aptitude is organizing and handling men, and another whose natural bent and training fit him to estimate costs, keep records, compile statistics and cost systems, and to act with his partner in an advisory

capacity on business and buying matters. This ideal combination originates usually from a good foreman and a young civil engineer.

Evidently the building business had its drawbacks and failures early in the history of the world, else the following would not have been a seemingly necessary precept of Holy Writ: "For which of you, intending to build a tower, sitteth not down first and counteth the cost, whether he have sufficient to finish it? Lest, haply, after he has laid the foundation, and is not able to finish it, all that behold it begin to mock him, saying, 'this man began to build and was not able to finish.'" This would probably be the experience of many an owner were it not for the bravery and courage of the average contractor, who "sitteth down first and counteth the cost," and then "puts up a bond and takes all the chances."

It is convincing that many low bids, and high ones too, for that matter, are, as Dr. Johnson says, "the result of sheer ignorance" as much as a desire in the face of common experience to prove that two and two equal five. Very seldom are serious mistakes made when one follows his own good judgment. There is no such thing as time in proportion to cost in estimating. On some buildings an estimator might spend three or four days on millwork alone, while on another a few hours would suffice. A thousand dollars of hardware might occupy as much time to take off as ten or twenty times that amount in brick or concrete work. Always keep the sub-totals of your estimate separate and complete in themselves. You can then always with safety alter or change price or quantity without making a risky change clear through the estimate.

Some contractors add the profit desired to each item or sub-heading; this is wrong practice; get the exact cost and add "all the profit at once." Never under any circumstances base your final proposal on an estimated cost given by the architect or engineer in charge of the job. Many times this pre-estimate is correct in quantity, but not in price; often the reverse is true. Depend upon yourself and not the other fellow. Also be your own price maker, even if your estimate is made up by an employee. The diversity of figures of sub-contractors requires your best judgment always. It is not always wise to use the lowest sub-figures you are offered, even if the low man is presumed to be entirely responsible. It usually leads to trouble and dissatisfaction later. Avoid verbal sub-bids, and be sure that bids tendered read "according to plans and specifications." Do not use figures based on quantity lists other than your own when your contract is over the plans and specifications.

Use Text Books Conservatively

Be very careful of making up estimates from some of the estimate books published. There are a large number of them that are of valuable assistance, but entirely inadequate for the constantly changing conditions and prices of the building industry. Be your own estimate book as far as you can and keep a clear record of costs. All of the foregoing suggestions and experiences are somewhat rambling and desultory, but may prove of more than passing interest to other contractors.

Several years ago there appeared in this magazine a summing up of the general qualifications of a contractor, taken from a speech of a prominent New York City contractor, and the wording was so true, so real, and so worthy, that it will readily bear repetition here: "There is no class of work that takes as varying quali-

ties or so many qualities as contracting. It appeals to men who are optimistic and to those who have born in them the longing for doing things. The contractor must be a man, first, of that most uncommon thing, common sense; and he must have physical sense, the sense that tells a man without calculating where lies the centre of gravity; the sense that tells a man values without estimating, the sense that tells a man quantities without measuring. He must have magnetism in order to gather his men about him. He must have reputation for justice in order to hold them. He must be forceful in order to inspire energy in others. He must be a lawyer and a buyer. He must have the ingenuity of the inventor, and the grasp of the field marshal. He must be a diplomat and he must be a politician. He must also know when not to be a politician. He must be a financier, and I regret to say, in these days, an advertiser, and he must be a prophet." And the writer most respectfully adds to the opinion of this eminent contractor the words, "and then some."

Hydraulic Dredge for Arrow Lakes, B. C.

ON account of the pressing and increasing demand for dredging in the interior lakes of British Columbia, the Dominion Public Work Department have decided to provide a modern dredge for use in that district, tenders for which have just been taken.

The dredge, with the exception of the upper house-work, is to be constructed of steel throughout. It is to be of the "cutter suction" or "hydraulic" type and will be self-propelling. The hull will be 116 ft. long over transoms, 30 ft. beam, 8 ft. 6 in. deep and will draw about 3 ft. 6 in. of water in working trim. The dredging capacity in free material will be about 250 cubic yards an hour. Plating at bow and stern will be made heavy enough to enable the dredge to steam through comparatively heavy ice without injury to the hull. Dredging depth will be 30 feet, with ladder inclined at 45 degrees.

The rotary cutter for breaking up the material to be excavated and feeding same to the suction pipe is worked by a powerful double cylinder engine bedded on the ladder and will be suitable for dealing with sand, clay, and gravel up to about six inches in size.

The ladder, which is hinged at its inboard end to the deck of the dredge, will be raised or lowered by wire rope tackle from a steel boom supported at the outer end by wire guys from a steel "A" frame. The suction pipe from the cutter head will be carried inside the plating of the ladder, being removable for examination or repairs, and connected to the stationary suction pipe on the dredge by means of a flexible rubber gooseneck.

The dredging pump will be of the usual type but fitted with a special design of stuffing box and an oil-lubricated thrust bearing in which the pump shaft collars revolve between shoes lubricated and cooled by oil continuously pumped in under pressure. With this method of cooling, the collars and shoes will be subject to very little wear, which is always excessive when water with its inevitable proportion of gritty matter is used. The pump will be driven by a triple expansion marine type steam engine, direct connected to the impeller shaft.

The boiler will be of the water tube type, especially designed for burning crude oil as fuel but will be so arranged that it can be quickly fitted up to burn coal. Fuel oil will be carried in two thwart-ships tanks of

about 200 barrels total capacity, built in the hull. Coal bunkers of about 40 tons capacity will also be provided.

The propelling engines will be of the regular stern-wheel river steamboat type with cylinders 14-in. diameter by 60-in. stroke, driving a stern wheel 18 ft. diameter. It is expected that the speed of the vessel when steaming in smooth water will be about eight knots an hour.

There will be two spuds, one forward and one aft. The former can move in a vertical direction only and remains raised when the dredge is working. The latter can oscillate in a fore and aft direction, and is fitted with a steam thrust cylinder by means of which the dredge can be moved ahead when changing cuts.

Swinging or manoeuvring the vessel when dredging is accomplished by means of wire rope cables attached to ground anchors and leading to pulley blocks secured to the ladder near cutter head, thence through fairleaders on deck to a pair of drums driven by a two-cylinder engine located on deck just forward of the dredging pump space. This engine also has drums for handling the ladder tackle and for raising the forward spud and will be handled entirely from an operator's room on second deck forward.

All auxiliary machinery is to be of the highest class and will include the following:—Independent surface condenser with combined air and circulating pumps, "Weir" type float regulated main feed pump, "Weir" type service donkey pump, duplex sanitary pump, outside packed duplex pump for supplying water to stuffing box of dredging pump, duplex pump for circulating oil to thrust of dredging pump, hand power test pump, etc. Steering the dredge when steaming from one place to another will be effected by means of a direct acting automatic steam steering gear manufactured by the Heaps Engineering Company, of New Westminster, B.C.

Owing to the fact that the dredge will frequently operate at a considerable distance from a repair shop, a very complete outfit of machine tools will be provided. These will be located on deck on each side of the dredging pump hatch and will each be direct driven by an electric motor. Current for these machines will be generated by a 15 kw. dynamo direct connected to a steam turbine. Storage batteries of large capacity will also be provided so that the electric lighting service can be kept in operation for a considerable time after the generator is shut down. The lighting system is most complete and will include a powerful electric searchlight located on top of the pilot house.

A three-ton capacity overhead travelling crane will extend completely across the dredging pump space, and provide means for lifting pump or engine parts and delivering them close to doorways in the sides of the lower house, as well as serving the machine tools.

On the second deck ample living and sleeping accommodation will be provided for a complete single crew. On the third deck there will be two staterooms with bathroom between for the use of engineering officials when making their regular visits of inspection. Cabin furnishings and galley equipment will be of the most complete description.

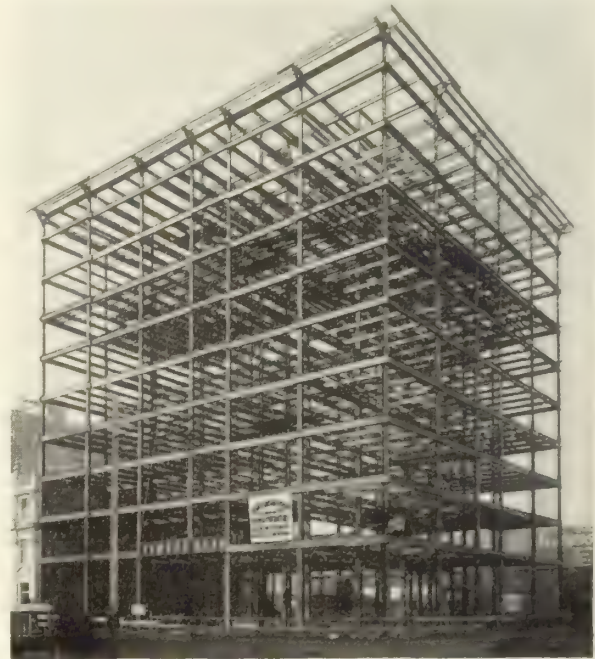
Forty pontoons for carrying the discharge pipe are to be provided. They will be constructed entirely of steel and be fitted with adjustable pipe bearers and saddles of special design. The discharge line will be of lap welded steel pipe in lengths convenient for handling and will be connected together with rubber sleeves clamped on.

The dredge and its auxiliary equipment were de-

signed by Mr. H. A. Bayfield, Mem. Am. Soc. Mech. Engineers, for Messrs. Cartwright, Matheson & Company, civil engineers, of Vancouver, with whom the Public Works Department has placed the order for the designs. The drawings, of which there are about thirty sheets, include all details of the hull and machinery and were prepared in the remarkably short time of three months.

Structural Features of the McLeod Building, Edmonton

THE erection of the structural steel frame of the new office building for Mr. Kenneth A. McLeod, at Edmonton, has been completed and the general contractors are about to proceed with the completion of the structure, a photograph of which is here shown. The building will have an entrance frontage on MacDougall Avenue of 118 feet, will be 100 feet deep, and ten storeys high. The exterior is to be of ornamental terra cotta and face brick for the street elevations, and will have ornamental-



Steel frame of the McLeod Building, Edmonton.

iron entrance and store fronts. The Dominion Bridge Company, Limited, of Winnipeg, supplied for the building over 950 tons of structural steel, the entire of which was erected in 29 working days. The foundations are steel I-beam grillages, made up of 18 and 20-inch beams from 10 to 12 feet long. The columns are all rolled H-sections, three storeys in length.

The ground floor is 19 ft. 5 in. high and will contain one large store, three small stores and two shops flanking the entrance. The vestibule and entrance hall will be highly decorated with marble and ornamental-iron work. There will be eight office floors, each with twenty office rooms with public toilet and vaults. A light court 39 ft. wide by 64 feet long will give exterior light to every room. The attic floor will contain house tanks and machinery. In the basement will be the engine and boiler room, with machinery space and storage. The steam heating system will consist of two horizontal tubular boilers with Cochrane-feed water heater, two boiler-feed pumps, and a vacuum pump, also a hot water heater with house pump in

addition. Two steam or motor generator sets of 75 kw. capacity will be installed for light and power. The entire building will be gas-piped and will be cleaned by a vacuum cleaning system. There will be three passenger elevators, having a travel of 112 feet, with cages 5 ft. by 6 ft., and ornamental iron grille enclosures.

The floors throughout will be terrazzo, and all interior trim is to be quartered southern white oak. Hollow metal will be used in the windows. The architect is Mr. John K. Dow, of Seattle. The general contractors are Messrs. Olson & Johnson of Missoula, Montana and Edmonton, for whom the work is being superintended by Mr. Frank L. Magee.

Quicklime Thaws Frozen Ground

In describing some difficult sewer construction at West Liberty, Ia., Charles P. Chase, the engineer in charge, gives the following details regarding the use of lime to overcome frost:

"The work which was described in a recent issue of Engineering News, was carried on through the whole winter when the ground was frozen to a depth of 4 ft., in which state it resisted all efforts of a trenching machine to break through it. The lime was spread over the frozen ground, covering the width of the trench to be opened and was then broken up into small

pieces and covered thickly with straw, hay or manure. Water was then poured on the straw so as thoroughly to slake the lime. Hot water was found best and hastened the slaking. The covering retained the heat, which, with the hot water, penetrated the frozen ground sufficiently to enable the trenching machine to make headway."

A New York contemporary, "Architecture and Building," in an effort to establish a connection between architecture and the stage after seeing a performance of "Omar the Tent-Maker" has something to say about the "architectural activities" of Omar and expresses the opinion that he had the makings of an excellent architect. This is rather a far-fetched allusion. We can offer our contemporary something far nearer the mark. Mr. Martin Harvey, whose recent performance of "The Only Way" and other plays in Canadian cities has brought him into such prominence, is the son of a well-known naval architect and was intended for his father's profession, but developed an early predilection for the stage. Mr. Harvey really has the makings of an architect. He is excellent in the portrayal of things that are not, he makes a hobby of drawing pictures, he gets his money easily, and, again, he is an excellent actor. Are there any further desiderata?

Mixing and Placing Materials for Concrete Roads

IN the construction of concrete roads, probably no really important part of the work is given less consideration, in specifications and in the field, than the actual mixing and placing of the concrete.

The following notes, based upon observations in the field, and the results of tests, were prepared with a view of pointing out the difference between good and bad practice, and to serve as a basis for recommendations covering this phase of the work.

Mixer.—The concrete mixer should be of the batch type provided with an automatic water tank, traction drive and power loader. Mixers having a boom and bottom dump bucket of sufficient size to convey one complete batch for placing the mixed concrete, are preferred. However, buckets of other types and sizes, and open troughs can be used and will give good results.

Experience shows that where a tube or spout is used for delivering concrete, it is necessary to mix the concrete too wet for the best results. Another objection to this system is that it may be operated like a continuous mixer, the supposition being that, as the spout is provided with blades and revolves, the materials are mixed in the spout. This spout serves only as a conveyor and cannot to any degree take the place of or serve as a mixer.

The mixer should be provided with a suitable automatic water tank which can be quickly filled and emptied, so that when once determined, the required amount of water can be added to each batch of concrete. A number of so-called automatic tanks on mixers are not satisfactory, owing to their limited capacity, delay in filling and emptying, and to the fact that they depend, for successful operation, upon a constant water pressure. Water is pumped on most road jobs, with small gasoline or steam pumps, and it is not possible to maintain uniform pressure in the feed line.

An automatic measuring tank of the required capacity, that may be emptied quickly, connected by means of a comparatively large pipe, with an auxiliary or storage tank of

about 50 gal. capacity, would be more satisfactory than the one-tank system commonly used.

Where necessary to keep from cutting up the subgrade and to facilitate moving, the wheels of the mixer should be run on suitable planking. Material of good quality, 3 in. thick by 10 in. wide, in comparatively short lengths with square ends, will be found satisfactory for this purpose.

The power loader or skip should be of sufficient size to hold all the materials required for the batch. In charging the skip a part or all of the coarse aggregate should be placed first, and the cement, fine aggregate, and remaining coarse aggregate, if any, on top of this. All the cement should be in the skip before the last of the aggregate is added. If charged in this manner there will be less tendency for the materials to stick in the skip when emptying and less loss of cement on windy days. A systematic method of loading the skip will also serve as a check on the right amount of material being placed each time.

The filling of the skip is accomplished in practice in two ways—by the use of wheelbarrows and by shovelling direct from the supply piles into the skip. This latter practice, however, should be discouraged, for accuracy is impossible, and it encourages carelessness. Besides, the entire loading gang loses time waiting while the skip is raised and lowered.

Mixing Concrete.—No important operation is given less attention than the mixing of the concrete. Frequently in practice, the time the materials remain in the drum is governed only by the speed of the gang charging the skip. At times the batch mixer is operated practically as a continuous mixer, by fastening the discharge scoop or spout so that there is a constant flow of concrete from the mixer.

The quality of concrete is largely dependent upon thorough mixing. To insure thorough mixing the revolutions per minute of the mixer and the time the complete batch, including water, remains in the mixer, should be specified. To specify either the r.p.m. or the time is not sufficient as it is plainly shown by field observations that there is not a di-

rect relation between the two. Upon inquiry of the manufacturers it was found that the r.p.m. of the drum of batch mixers varies for different makes and for different sizes of the same make.

Because of the shape and arrangement of the interior of the drum, the rate at which a given mixer is operated has a direct bearing upon the quality of the concrete; therefore the drum should be operated at approximately the speed at which the manufacturer claims the best results would be obtained.

It is recommended that all specifications contain a clause to the effect that all the materials in any one batch—including the water—should remain in the drum of the mixer at least 45 sec. before any of the concrete is discharged.

In all cases the drum should be completely emptied before the next skip of materials is dumped into the mixer. This is a source of constant controversy between the engineer or inspector and the contractor, especially where the mixer is used equipped with an open trough, or with a boom and bucket when the bucket is not large enough to hold the whole mixed batch.

The operator should start the water into the drum as soon as the skip is in position to dump—that is, it is not necessary to mix materials dry before adding water.

Consistency.—The practice on road work is to mix concrete entirely too wet. This causes a separation of the coarse materials from the mortar, resulting in stony pockets throughout the concrete. Where the concrete is mixed too wet, it is practically impossible to obtain and hold the required crown, and stony patches frequently appear on the surface after it has been finished, owing to the flow of water and mortar to the sides. In striking off and floating concrete mixed with an excess of water, it is also practically impossible to obtain a surface of the desired character, as the excess of water collects in and hides depressions and other inequalities in the surface, which cannot be corrected as they are not apparent until after the water has evaporated.

In addition to the difficulty encountered in getting wet concrete into the pavement in a manner which will give the best results, laboratory tests and results observed in the field show that, other things being equal, a wet mixture is of inferior strength and quality to concrete of a medium wet consistency. The marked effect in the strength of concrete that a variation in the consistency produces, is shown in the tests made in the Sheffield Scientific School of Yale University by Charles J. Robison.

Expansion and Contraction.—As yet there is not sufficient data on which to base a definite conclusion relative to the influence of the consistency of concrete upon the expansion and contraction; however, information at hand seems to show that this action is influenced very largely by the consistency.

Owing to the methods employed in striking off and finishing the surface of concrete pavements, there is little likelihood of mixing the concrete too dry. Concrete mixed with an excess of water is easier to mix, to handle, to place and to finish, than concrete of the proper consistency, which explains the tendencies toward wet mixtures.

The amount of water in the concrete should be such as to cause it to settle to a flattened mass when dropped from the bucket, but not sufficient to cause it to flow readily on the subgrade. The consistency should be such as not to require tamping, but not so wet as to cause a separation of the mortar from the coarse aggregate in handling and placing. If there is an excess of water on the surface, or the mass has a tendency to flow or settle out of position after being floated, the concrete has been mixed too wet.

Placing Concrete.—Just before placing concrete, the subgrade should be well sprinkled so that it will not absorb moisture from the concrete, and should be checked by the en-

gineer or inspector to make sure that the required thickness of concrete can be placed. Checking the subgrade may be done by the use of a straight-edge or line, resting on, or stretched from the top of the side forms.

Probably the most satisfactory method of depositing the mixed concrete in position on the subgrade is by means of a bottom-dump bucket running on a swinging boom free from the mixer. The boom can be swung over any position on the subgrade, and the bucket can be run out and dumped at any point along the boom. Such equipment does not depend for economic operation upon consistency and the concrete can be easily handled and deposited at any place on the subgrade necessitating but little handling with shovels. Between each change in position of the mixer a section, the full width of the pavement (up to $1\frac{1}{2}$ times the length of the boom, and as long as the boom), may be concreted.

When concrete is placed by means of the open trough, care must be exercised to see that it is not mixed too wet, as this method of distribution depends for economic operation very much upon the consistency of the concrete. An open trough is necessarily much shorter than a boom and is more limited in action, which requires that the mixer be moved ahead more often, also that more of the concrete after being deposited on the subgrade be handled with shovels.

When a batch mixer, not having a boom and bucket or open trough, is used, the concrete should be handled in wheelbarrows or hand carts wheeled on suitable runways. Placing concrete by means of horse carts should not be permitted as they cut up the subgrade badly and to get the concrete into final position requires a maximum amount of shovelling.

Whatever the method of conveying and placing, the concrete should be deposited upon the subgrade to the required depth and for the entire width of pavement in as nearly one operation as practical so as to reduce handling to a minimum. If it is necessary to handle a large amount of material with the strike-board it will ride the concrete and thus produce a wavy, uneven surface. Attention to this matter will materially lessen the difficulty and labor in striking off the surface and will result in a very much better finish.

The excess of coarse material that accumulates in front of the strike-board should be uniformly distributed over the surface of the pavement and not left in narrow strips across the section, or placed along transverse expansion joints. An ordinary garden rake will be found useful in distributing the material that accumulates in front of the strike-board. When the strike-board is within 2 ft. of an expansion joint the excess material that has accumulated in front of it should be removed with a shovel and deposited on the subgrade in the next section. Special care should be taken to place good, dense concrete along expansion joints, and all inequalities at the joints, including any small holes left after the removal of the installing device, should be filled with a mortar composed of one part cement and not more than two parts fine aggregate.

The man handling the strike-board should follow closely behind those placing the concrete, for keeping up with the strike-board will materially assist those placing concrete in depositing the required amount of material.

The placing of concrete should be a continuous operation, and stops should be made only at expansion joints. In case the mixer breaks down concrete should be mixed by hand to complete the section, or an expansion joint should be placed at the point of stopping work. Any concrete in excess of that needed to complete the section, when work is discontinued, should be spread out in a thin layer, not exceeding 2 in. in thickness, over the subgrade in the next section and not piled up along the expansion joint.

The strike-board should be cut to conform to the crown of the finished surface of the pavement and should be of

sufficient strength and stiffness to show no deflection at the center when supported at the ends, nor a material bowing out of alignment when in use. It should be about 2 ft. longer than the width of the road, protected on the bottom edge with a metal facing and provided at each end with suitable handles.

For roads up to 12 ft. in width two 2 x 6-in. planks, dressed on one side and both edges, spiked together, make a good strike-board, and for roads 12 ft. to 20 ft. in width two 3 x 8-in. or a 2 x 10-in. and a 3 x 10-in., spiked together, will be found satisfactory. Two planks, well spiked together, make a better strike-board and one less likely to warp out of shape than a single piece. The strike-board should not be so heavy that it cannot be easily handled by two men, and to reduce weight and increase stiffness, it is advisable for work over 20 ft. in width to use a strike-board composed of boards 2 in. or 3 in. thick, stiffened by trussing, rather than obtain the required stiffness by the use of heavier timbers.

In striking off a pavement 16 ft. or less in width, where the concrete has been properly placed, two men should be able to handle the strike-board, but for wider pavements the services of a third man will be required to assist in pulling the board forward by means of a drag line fastened at its center.

The strike-board should always be worked forward about perpendicular to the axis of the roadway and as it is moved ahead should be sawed back and forth across the road.

To produce the desired effect will require that the strike-board be passed over the surface of the concrete two or more times.

Though it will be necessary for the workmen to get into the concrete soon after it is deposited on the subgrade, it is desirable that all unnecessary walking in and wading through the concrete be avoided, and under no circumstances should any workmen step upon the concrete after it is first struck off.

Western Builders in Session at Edmonton

Special to the Contract Record

THE Western Section of the Canadian National Association of Builders' Exchanges held their annual convention in Edmonton, February 24 to 26 last. At the opening session, addresses of welcome were delivered by Mr. T. H. Miller, president of the Edmonton Exchange and Mr. W. J. McNamara, mayor of Edmonton. On the morning of Wednesday, February 25, the members listened to an interesting paper on "Reinforced Concrete," given by Mr. J. P. O'Leary, managing director of the Standard Construction Company, Limited, Saskatoon, and also to an instructive paper on "Education in the Building Trades," given by Professor Burgess of the University of Alberta. An important session was held on the afternoon of February 25, when the reports of the various committees were considered.

The special committee reported several important resolutions, most of which were adopted as read. It was resolved that the Association should use its influence to secure legislation looking to the establishment of state liability insurance. Before the adoption of the resolution there was a lengthy discussion of the matter. Mr. Davidson, of Winnipeg, outlined the situation in Manitoba. For two or more years now there has been in operation in Winnipeg a Master Builders Employers' Liability Insurance Association. During this time they have paid out an indemnity for every accident, no matter where the fault. An agreement has recently been reached between the members of the Provincial Association of Builders' Exchanges, the Labor Councils and the Provincial Government, whereby they are about to enact legislation for the establishment of a Commissioner to handle all employers' liability insurance, as has been done by the above-mentioned association. This Commissioner will be authorized to classify all accidents, proportion the mortality, strike a flat rate for all employers, and finally indemnify all victims of accidents. As at present arranged, the indemnity is in proportion to the class of the accident, depending also upon whether the victim is married or single, and upon the number of dependent children.

The Wage Act recently enacted in the province of Saskatchewan was discussed, and it was agreed that the Association was opposed to this act, which provides that all wages must be paid at the end of seven days, allowing no time in which to make up any payrolls, no hold back or lie-over, and preventing the contractor in many ways from securing such tools and other property as his workmen may be using. The Convention was unanimous in condemning the terms of the Act as read. Of late there has been a good

deal of agitation in the prairie provinces over the requirement of the deposit of a marked cheque to the amount of ten per cent. of the contract on all Dominion and Provincial Government work, and the Convention resolved to petition the governments and request that in the future a sufficient bond should be substituted. In addition it was resolved to petition all provincial governments to establish technical schools as a part of their education system. The Dominion Parliament will be requested to establish intercommunicating employment bureaus throughout the Dominion. Recently the Montreal Builders' Exchange took action in the matter of asking the government to enact a Dominion Bankruptcy Law, and the Convention went on record as being in favor of such an Act.

While much of the time was devoted to the business of the Convention, the hospitality of the city of Edmonton was enjoyed fully. On the first night of the Convention a banquet was tendered the visitors. At this function there were over 250 persons present. On the next evening there was a very enjoyable smoker. On the last day of the meeting, all were guests of the Edmonton Industrial Association at a luncheon at which five hundred were served.

The final business meeting was held on the morning of February 26, at which it was decided to meet the next year in Saskatoon, the largest city in Saskatchewan. The following officers were elected for the coming year: President, Mr. C. R. Frost, Edmonton; 1st Vice-President, Mr. J. P. O'Leary, Saskatoon; 2nd Vice-President, Mr. James Bourgeault, Winnipeg; Honorary Secretary, Mr. A. M. Frith, Edmonton.

The fourth American Road Congress, and the convention of the American Highway, all its affiliated organizations, and the American Automobile Association, has been scheduled for Atlanta, Georgia, during the week beginning November 9, 1914.

Prospects for a good season in the building trade in Winnipeg are exceedingly bright, according to a statement made recently by Mr. Rodgers, Building Inspector. The records so far are greatly ahead of last year as will be seen from the following figures:—February, 1914, 81 buildings, 73 permits, value \$771,700; January, 1914, 89 buildings, 83 permits, value \$595,800; total for the year, \$1,367,500. February, 1913, 149 permits, valued at \$725,800, while for the month of January and February last year the aggregate was \$1,107,000.

Montreal Water Conduit—Experts' Findings and Recommendations

MESSRS. J. A. Jamieson, R. S. Lea and G. R. Heckle, the engineers appointed to report upon the break in the Montreal water supply conduit, have submitted their report to the Board of Commissioners. Their conclusions and recommendations are abstracted below:

Conclusions

1. That the plans and specifications of the conduit did not call for sufficient reinforcement, nor is the steel properly placed in the concrete section, to provide a sufficient factor of safety, especially in view of the fact that the conduit would be the only means of supplying the city with water during the enlargement of the aqueduct.
2. That in the construction of the conduit the quality of the concrete and the workmanship generally were good, but that the weight and strength of the steel reinforcement was much less than called for by the specifications submitted to us.
3. That the insecurity of the conduit was greatly increased by the proximity of the excavation involved in carrying out enlargement No. 2.
4. That the method of performing the work by means of



The break in the Montreal conduit.

a heavy drag-line excavator travelling on top of the bank above the conduit imposing a heavy vibrating load concurrently with the removal of the earth which provided lateral support to the conduit further endangered the structure.

5. That the leakage of water from the conduit is an additional source of danger at points where the conduit is located in easily eroded soil, and the excavation carried sufficiently close to permit the water finding an outlet into the aqueduct.
6. That the failure of the conduit was due to the proximity of the excavation, to the methods employed in the execution of the work, and to the inherent weakness of the conduit itself.
7. That the conduit, as a permanent means of supplying water to the city, is not now to be depended upon.
8. That it would be unsafe to proceed with any further excavation in the earth section on the north side of the aqueduct with the conduit in its present condition and while there is no other water supply available.
9. That it is unsafe to do any blasting in the rock section on the north side of the aqueduct.
10. That it is unsafe to allow the travelling excavators or locomotives or any other similar heavy machinery to be

operated on or moved at any point over the top of the conduit.

11. That the reinforced concrete retaining wall as designed by the city and to be built by the Cook Construction Company along the banks of the aqueduct in the earth sections is not, as designed, a safe structure to build for the purposes intended.

12. That a revision of the design of this wall, in order to make it safe, will greatly increase the cost of the project.

Recommendations

1. That before any further work is proceeded with, at least on the north side of the aqueduct, an investigation be made by a commission of engineers into the entire aqueduct scheme, which will include revised estimates of the cost of construction, and the quantity and cost of the power developed.
2. That the city at the earliest date possible make arrangements for providing a new and independent water supply of a suitable character, so located that it cannot be affected by any further accident which might happen to the present conduit.
3. That a permanent cofferdam or intake be at once constructed at the entrance to the aqueduct including proper gates or sluices that may be required, so that the flow of water into the aqueduct may be at all times under control.
4. That until another suitable water supply has been provided the present one should be kept continuously under observation so that in case the present leaks become serious prompt remedial measures may be taken.
5. That the suction pipes of the pumps at the pumping station be lowered by at least six feet as soon as possible so that the conduit may be run partly full or may be quickly emptied.

City Engineer Janin, of Montreal, has issued a lengthy statement in reply to the report presented recently by Messrs. Jamieson, Heckle & Lea. Mr. Janin contends that the conduit is safe and that the construction of a duplicate conduit is unnecessary. He maintains that the accident of last December was entirely the fault of the contractors, who excavated too close to the conduit and below the level of the proposed aqueduct. He recommends that the construction of the emergency intake be carried to completion as soon as possible.

Extensive Harbor Development at Montreal

An extensive construction programme for the next four years has been outlined by the Montreal Harbour Commissioners, and the Government have been asked to allocate \$15,000,000 for the purpose. During the current year it is proposed to expend \$4,500,000, the main work being the erection of two large warehouses, the elevation of the railway tracks between McGill street and Victoria Pier, and the electrification of the harbour railways. As much of the electrification of the railways as possible will be completed this year. The trackage will also be extended to Pointe aux Trembles, the ultimate terminus being Bout de l'Île. It is expected that there will be about three-fourths of a mile of the elevated tracks finished this year.

The South Shore bridge, to connect St. Helen's Island and St. Lambert with Montreal, is also recommended by the commissioners. Work on the South Shore this year includes the laying of eight miles of electric railway; a new South

Shore channel to be dredged to twenty feet; and a new industrial wharf at Longueuil for the Armstrong-Whitworth plant. Railway terminals will also be constructed in Longueuil this year the 1,000,000 acres farm of the Government having been deeded to the Commissioners.

Several changes are being made in the Lachine canal. The first two locks are to be entirely removed and replaced by a single standard one-lift lock. Pier number one will be extended to meet an extension of the Bickerdike Pier and will provide accommodation for five additional steamers, and several additions are to be made to the Alexandra, King Edward and Jacques Cartier Piers. The improvement of Victoria Pier is also to be continued and 2,700 feet of high level and 4,800 feet of low level wharfage are to be built. New sheds are to be built at sections 20 and 25, and a concrete pier for the Canada Cement Company at Longue Pointe. Dredging is also to be carried on. Over \$800,000 will be spent on elevator No. 2.

Canada Cement Company Optimistic

At the recent annual meeting of the Canada Cement Company, Limited, held in Montreal, Mr. Frank P. Jones, the general manager, gave a few remarks on the outlook for the present year. Mr. Jones stated that at the middle of February, this year's sales were 27 per cent. behind a year ago. However, there had never been a year in the history of Canada and the United States that had not shown an increase over the preceding year in the consumption of cement. The exact output of the company last year was given as 8,913,000 barrels. This was an increase of a little under five per cent. over the previous year, and 100 per cent. over 1909. Regarding the work in view, although as large a consumption was not expected in the West, owing to cement roads and other undertakings under way, the East would most likely show a substantial increase. When asked what danger there might be from United States competition, Mr. Jones replied that cement was cheaper on this side the line than on the other and while it sold at \$1.25 per barrel at the head of the Canadian lakes, it sold at Duluth at \$1.35 per barrel. As a matter of fact, only 250,000 barrels had come into the country last year. At a meeting of the Portland cement people in Chicago last year, he found more alarm at the prospective invasion of the United States by Canadian cement than in any other feature. Some thirty-five United States plants had gone into the hands of receivers, consequently he did not think that they were going to continue throat-cutting competition much longer. Mr. Jones believed that while Canada was a protectionist country, the government would give the same measure of support to cement as to any other industry.

Mr. J. P. O'Leary, Managing Director of the Standard Construction Company, Limited, of Saskatoon, Sask., who presented a paper on "Reinforced Concrete in Modern Structures" before the Western section of the National Association of Builders' Exchanges, in Edmonton, on February 25th, was born in Quebec in 1859, and has been connected with some of the best known architects in Canada, as Superintendent. In 1895 he built the Place Viger Hotel, the Chateau Frontenac, the Royal Victoria College, all for Bruce Price. Later he went to Texas, where he was superintendent on several hotels for the firm of Burnham & Root, of Chicago. Since then he was superintendent in charge of the construction of the C. P. R. Empress Hotel in Victoria, the Royal Alexandra in Winnipeg, and the Lake Louise Hotel in the Canadian Rockies. In 1909 he was in charge of the buildings for the University of Saskatchewan for Brown & Vallance, of Montreal, after which he went into

contracting in the city of Saskatoon. He has been elected 1st Vice-President of the Western Section of the Canadian National Association of Builders' Exchanges.

Personal Mention

Mr. A. F. Macallum, City Engineer of Hamilton, has been elected a member of the American Society of Civil Engineers.

Mr. James Vance, who had been engaged in bridge construction work for many years with the Hamilton Bridge Company, died at New Hamburg, Ont., on February 28.

Mr. H. G. Hunter, Resident Engineer for Canada of the New York Continental Jewel Filtration Company, was recently elected a full member in the Canadian Society of Civil Engineers.

Mr. J. C. Dufresne, M. Can. Soc. C. E., has resigned the position of Field Engineer for Messrs. Cummins & Agnew, of Vernon, B.C., in order to re-establish his private practice at Penticton, B.C.

Mr. Robert Bruce, of Ottawa, Ont., has been appointed successor to the late Mr. George Brophy, as Superintending Engineer of the Ottawa River Works, under the Public Works Department.

Mr. A. M. Bouillon, District Engineer of the Grand Trunk Railway, Quebec City, has been transferred from the Associate class to that of Membership in the American Society of Civil Engineers.

Sir William Willcocks, builder of the Assuan dam, Cairo, Egypt, has promised to attend the convention of the National Drainage Congress, to be held at Savannah, April 22-25, when he will lecture on "River Regulation and Control in Antiquity."

Mr. P. B. Yates, who has been connected with the Ontario Hydro-electric Power Commission for the past five years, has received an appointment as Engineer and Manager of St. Catharines Hydro-electric power system. Mr. Yates takes up duty on March 15.

Hon. Angus McDonnell is at the head of Messrs. McDonnell, Limited, who are associated with Messrs. Grant, Smith & Company, in the contract for new wharves and docks at Victoria, B.C., involving an expenditure of two and a quarter millions. The Hon. Angus McDonnell is the son of Lord Antrim. He was recently married to the daughter of Arthur Jones, the well-known English playwright.

Mr. John O. Brown, C.E., who was a well-known railroad builder, died at the Victoria Hospital, Fredericton, N.B., recently, at the age of 71. The late Mr. Brown had been identified with the construction of several important railroads in Canada and the United States. He built, owned, operated and finally sold out the Northern Railway and was interested in the building of what is now part of the northern division of the C. P. R. in Madawaska County.

Mr. S. Barlow Bennett, for the last two years City Engineer of Nanaimo, B.C., has been appointed engineer of the municipality of South Vancouver. During his tenure of office at Nanaimo, Mr. Bennett has been a frequent contributor to the Contract Record and we join with his western friends in congratulating him upon his appointment to a post which will afford greater scope for his abilities. South Vancouver, we are told, covers 9,000 acres and embraces a population of over 30,000. Detailed mention of Mr. Bennett was made in our issue of December 31 last. Mr. Bennett is an Englishman, a native of Burslem in Staffordshire. After extended experience in municipal engineering in the old country, he came to Canada in 1911 to accept the city engineership of Nanaimo.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

At Port Arthur plans are being prepared for a new court house estimated to cost \$125,000.

The Bloor-Danforth viaduct for Toronto, on which construction will begin in the summer, is estimated to cost at least \$2,500,000.

Building permits issued at Montreal from January 1 to February 28 totalled in value \$905,700, compared with \$1,106,297 for the corresponding period of 1913.

Windsor records one of the greatest increases in its history and Mr. Brian, City Engineer, states that the permits for March promise to exceed even those of February.

The construction of open-hearth furnaces at a cost of \$2,500,000 is contemplated by the Algoma Steel Corporation, Limited, Steelton, Ont. Tenders will be received early in May.

Messrs. Frost & Winchester Company, Detroit, Mich., are the contractors for 100 residences to be erected at East London, Ont., at a cost of \$200,000 for the McCormick Manufacturing Company.

The Association of Dominion Land Surveyors held its eighth annual dinner at the Chateau Laurier, Ottawa, on March 3. The function was very largely attended and proved one of the most successful on record.

A private Bill has been presented in the Dominion Parliament on behalf of the Niagara-Welland Power Company seeking a charter to dispose of power that will be developed by the building of the new Welland Canal.

For building activity the present year's total promises to surpass all previous records for London, Ont. Already the building permits are almost double those for the same period of 1913, being \$73,270, as compared with \$36,855 for the same period last year.

At Hamilton, Ont., operations will shortly be commenced on the Royal Connaught Hotel, estimated to cost \$1,000,000. The architects are Messrs. Eisenwein & Johnston, of Buffalo, N.Y., and the general contractors, Messrs. John H. Parker Company, Limited, New York City and Toronto.

The Canadian branch factory of the H. Mueller Manufacturing Company is to be enlarged in the near future to accommodate the steadily growing business of this important addition to the industrial plants of Sarnia. New machinery, including steam hammers, moulding and tool-making machines, have been ordered.

The tender of the Hamilton Bridge Works at \$76,625 has been accepted for the steel work and superstructure of the new McKittrick Bridge on King Street west, Hamilton. The McKay-Paulin Construction Company, of the same city, will do the excavating, grading and approaches for \$33,794. Exclusive of tiling the bridge and approaches will cost \$110,-

Building operations in Toronto for the first two months of 1914 represent in value about \$800,000 short of the total of permits issued in the corresponding period of last year. For February of 1913 the value of permits totalled \$1,549,210,

as against \$1,153,215 this year. The figures for January and February of 1913 are \$2,825,294, as compared with \$2,048,610 for the present year.

Mr. H. Beauregard, general contractor for the macadamized road which the Quebec Government is building between Charlemagne and St. Augustin, on the north shore of the St. Lawrence, a distance of 152 miles, has announced that at least 60 miles will be completed this year. The contractor has three years to complete the work for which he receives \$7,855 per mile.

A new scheme for the widening of Yonge Street, Toronto, has been submitted to the works committee by Mr. Forman, assessment commissioner. The scheme is to widen the thoroughfare on the east side from College to Heath Streets and on the west side from Lawton Avenue to the north city limits, at an estimated cost of \$2,000,000. This is said to be a decrease of \$1,000,000 over the original scheme.

A detailed inspection of the principal European ports is to be made during the next two months by Mr. W. G. Ross, president of Montreal Harbor Board, Mr. F. W. Cowie, chief engineer, and Mr. M. P. Fennel, assistant secretary-treasurer of the Board. The idea of the tour is to collect data from the most modern European ports to apply to the important programme of the harbor commission for the port of Montreal.

The principal works to be carried out by the Montreal Harbor Commissioners during 1914 include the construction of two new freight and transportation sheds to accommodate the Hamburg-America and Canadian-Northern weekly services; the electrification of the entire system of harbor railways; the elevation of the railway tracks between McGill Street and Victoria Pier, and the building of a large warehouse in Moreau Street.

The J. H. McKnight Construction Company, Limited, has entered suit against the Ontario Good Roads Commission for \$14,500 and interest from December, 1912, on account of work of macadamizing the Lake Shore road from Toronto to Mimico. The work was stopped by the cold weather and the commission was satisfied, but payment was not made because the village of Mimico, which was required to pay one-half the cost, has not yet remitted its share to the commission.

Several Ontario municipalities are seeking ratification of by-laws to cover the cost of local improvements. Fort William, which owns its own street railway, telephone and lighting system, has presented eleven by-laws for approval, calling for an outlay of \$8,000 to be used in improving the different municipal services. Lindsay seeks permission to expend \$22,000 in improving its drainage system, and the Peterboro' Radial Company want power to increase their bonds from \$20,000 a mile to \$35,000.

A new factory for the manufacture of wrought steel sash, roof glazing and skylights, has been completed at Peterboro, Ont., for the firm of Henry Hope & Sons, Limited. The structure is of brick and steel, 200 feet long by 180 feet wide, and proves the adaptability of steel sash and saw-

tooth roof to the modern factory. The building is fitted throughout with carrying tracks and travelling cranes, whilst the machinery for the plant was specially designed and embodies the most modern improvements.

A detailed report on garbage collection and disposal for Toronto, for which the ratepayers voted \$1,000,000 in January, 1912, has been presented to the works committee by Mr. Wilson, street commissioner. The report provides for local incineration of rubbish and the disposal of garbage in a combined central plant located at Ashbridge's Bay, with loading stations at the cattle market annex and in the north-western and northern sections of the city for the transfer of material to the central plant, the estimated cost of which is \$720,000.

Owing to the growing importance of the construction and maintenance of roads, the Quebec Government this season passed a Bill providing for a portfolio for a Minister of Roads, an office hitherto combined with that of Agriculture, and Mr. Joseph A. Tessier, M. L. A. for Three Rivers, has now been appointed to the new office. The Government have a large road-making programme, and are lending considerable sums to municipalities who are prepared to bear a share of the cost of improved highways.

An expenditure of \$2,273,559 during 1914 is recommended by the Harbor Commissioners of Quebec in the annual statement laid before the legislature recently. Of this sum \$400,000 will be expended on dredging; \$952,029 on extensions to Louisa embankment together with the necessary filling; \$108,964 for the purchase of Indian Cove property; \$500,000 to provide grain loading galleries in the new grain elevator. These galleries will be of fire-proof construction, capable of delivering grain to ocean vessels at the rate of 40,000 bushels an hour.

The St. Catharines board of trade, comprising about 300 of the largest ratepayers in the city, has passed a resolution expressing its appreciation of the Federal Government for undertaking the construction of the new Welland Ship Canal, as one of the links in a deep waterways system from the ocean to the head of the Great Lakes, and thus to the centre of the North American continent; urging the deepening and widening of the other waterways of the Great Lakes and St. Lawrence route, but endorsing the action of the government in delaying construction of the proposed Georgian Bay Canal pending a recommendation by a government commission composed of men of expert engineering ability.

According to the programme of the Quebec Harbour Commissioners, the sum of \$2,273,559 will be spent on improvements this year. The chief item is the extension of the St. Louis embankment, which is estimated to cost \$952,000; while dredging a trench for a quay wall and channel approach will absorb \$400,000. Other works include railway terminals for extending the delivery yard accommodation, trackage for the new grain elevator, and railway tracks to serve the bulkhead quay wall and an additional freight shed in connection with the car ferry terminals. Grain-loading galleries in the new grain elevator are estimated at \$500,000, and the retaining wall at Lampson's Cove for a length of 1,400 feet at the sum of \$137,565.

The Department of Labor has issued a statement based on reports gleaned from one hundred localities throughout Canada concerning building operations during 1913. From this we find that the total value of building permits issued is \$178,069,838, a decrease of \$45,666,639 as compared with 1912. All the provinces, with the exception of Prince Edward Island, New Brunswick and Quebec, show decreases. In these three provinces there were gains of \$190,400; \$1,843,550 and \$2,202,511 respectively. The decreases in the other provinces were:—Nova Scotia, \$118,757; Ontario, \$1,908,826; Manitoba, \$2,608,792; Saskatchewan, \$975,115; Alberta, \$17,183,007, and British Columbia, \$18,408,603. In almost all the big centres

throughout Canada building operations reached the high-water mark in 1912. The one outstanding exception is in the case of New Brunswick, where an increase of \$1,843,550 over the 1912 figures is reported.

WESTERN CANADA

Humboldt, Sask., is taking tenders for a waterworks and sewerage system estimated to cost \$250,000. Bids close April 15.

Mr. A. G. Sangster is putting in the intake for the new waterworks system at Le Pas, Man., estimated to cost \$200,000.

Western Pavers, Limited, Winnipeg (Mr. Chas. Curtis, Manager), have twenty miles of concrete walk under contract in Winnipeg.

Calgary University will erect a dormitory building at a cost of \$250,000. The president, Dr. Blow, is the authority for the statement that work will commence in the spring.

The contract for the new wharves and docks at Victoria, B.C., has been awarded to Messrs. Grant Smith and Company, and McDonnell, Limited, two Vancouver firms, at \$2,244,795.

On the date of this issue, March 11, the ratepayers of Regina will vote on by-laws to raise \$360,000 for the extension of the waterworks system, \$170,000 for storm water sewers, and \$160,000 for the extension of the electric lighting and power systems.

Mr. J. Haddin, Consulting Engineer with the John Galt Engineering Company, Vancouver, visited Vernon recently and made an examination of the sewer system of the city with a view to ascertaining the best way to bring the system up to the required standard.

The Dominion Government are erecting an Immigration Hall and Customs Examining Warehouse in Moose Jaw this year. Work will commence on these buildings early this spring. The Armories, which are being erected at the head of Main Street, are almost completed.

Work on the construction of the Pacific Great Eastern line, between Fort George and Newport, B.C., is proceeding rapidly on clearing and grading, both north and south of Clinton. Work has been commenced already on the building of the first bridge to be completed along the route twenty miles north of Squamish.

In connection with the new water system for Greater Winnipeg, the expenditure upon which is placed at \$13,500,000, a number of important contracts have been awarded recently. Of these the most noteworthy is one for the grading and laying of about 85 miles of 60-lb., 4 ft. 8½ in. steel rails, awarded to the Northern Construction Company, Union Bank Building, Winnipeg, at \$500,000.

A new building has been erected in Brandon, Man., for the Gordon Mackay Company, of Toronto. It was erected by the Shapley Construction Company, Limited, Winnipeg, and is 150 ft. by 117 ft., being fireproof throughout. In the construction about 4,000 cu. yds. of concrete, 220 tons of steel and one-quarter of a million feet of lumber were utilized. The basement is done in mastic asphalt and the other floors finished in hard metal.

The annual convention of clayworkers of the Province of Alberta was held in Edmonton recently, when the delegates were welcomed by the Mayor. Several interesting addresses were delivered and papers dealing with the clay-working industry were read. A Publicity Committee, for the purpose of advertising and making known Alberta clay products through the medium of trade journals, was appointed, and Mr. J. P. Henry of Edmonton, was elected President for the ensuing year.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Aylmer, Que.

It is understood that the Town Council will do nothing further with regard to the proposed extension to the intake pipe until next January.

Banff, Alta.

Tenders addressed to Lyndwode Pereira, Sec. to the Dept. of the Interior, Ottawa, will be received until April 6th, for the supply of 13,500 lineal feet, 20 in. diameter lapwelded steel pipe, and 12,000 lineal feet, 6 in. diameter cast iron pipe for the water system. Plans are at the office of the Commissioner of Parks, Ottawa, the Chief Supt. Dom. Parks, Edmonton, and the Supt. of Rocky Mountain Park, Banff.

Belmont, Ont.

The town council has under consideration the question of laying cement walks in the town.

Dundas, Ont.

The Public Utilities Commission propose to replace the service iron pipes from mains to houses by lead pipes in the spring.

Estevan, Sask.

By-laws will be submitted to the rate-payers on March 31st, for authority to spend the sum of \$3,500 on pipe, valves, hydrants, meters, etc., and \$68,000 on the installation of vitrified clay pipe sewers.

Gloucester Twp., Ont.

Tenders will be called in about a month's time for the installation of a drainage system to cost \$35,000. \$11,000 will be added to this estimate for the construction of culverts and bridges over the cuts. Engineers-in-charge, Stidwell & Magwood, Cornwall, Ont.

The Twp. Council has decided to make certain roadways at an estimated cost of \$9,000.

Hamilton, Ont.

A committee composed of Aldermen Birrell, McQuesten and Tyrrell has been appointed to report on the matter of the proposed Kenilworth Avenue subway.

Hullett Twp., Ont.

Tenders will be received by Council Clerk, James Campbell, Londesboro, until 3 p.m. March 27th, for the digging and construction of Bowes Award drain in the Townships of Hullett and Morris. Plans and specifications at the office of the clerk.

Kingston, Ont.

The City Engineer will shortly call tenders for the construction of about 50,000 sq. yds. asphaltic macadam roadway, together with concrete curbing and gutters.

Leamington, Ont.

The town council has plans in progress for the laying of tile sewers. Engineer, G. A. Baird.

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North Battleford, Sask.

Tenders will be received by the Commissioners until noon March 16th, for the supply of vitrified tile sewer pipe and cast-iron water pipe. Specifications at the office of the Engineers, Chipman & Power, 47 Canada Life Bldg., Winnipeg, Mail Bldg., Toronto, and at North Battleford.

Tenders for the construction of pumping station, to cost \$4,000, will be called by the City Council.

Ottawa, Ont.

Tenders will be received by the engineer, Arch. Currie, City Hall, who will also furnish description of pump and tank required by the Waterworks Dept.

Regina, Sask.

The city council has plans in progress for the construction of a subway on Winnipeg St., at an estimated cost of \$90,000.

Tenders will be received by Commr. L. A. Thornton, until March 16th, for galvanized corrugated iron for roofing and siding for filter bed No. 5 at the Sewage Disposal Works. Engineer, F. McArthur.

Sussex, N.B.

The Town Council is considering the installation of a sewerage system, using 30-inch pipe, at a cost of \$40,000. Engineer, Grey Murdock, Carmarthen St., St. John, N.B.

Thorold, Ont.

The town council proposes to lay sewers on Pine, Shriner, Battle and Martin Sts. Estimated cost \$7,053.23.

Timmins, Ont.

The town council proposes to issue debentures to cover the cost of pavements and sidewalks and additions to the water works and sewerage system. Clerk, Thos. W. Wilson.

Toronto, Ont.

Tenders will be received by the chairman, Board of Control, until March 17, for asphalt pavements on Concord, Dupont, Hartford, Herbert, Mountjoy, Mountalan and Mountnoel Sts., and bitulithic pavements on Brock Ave., Gilard and Mountjoy Sts.

Tenders will be received by the chairman of the Board of Control until March 17th, for sewers on 24 streets. Plans, etc., are at the office of the Commr. of Works.

Tenders close March 17th for the supply of vitrified paving blacks. Specifications, can be seen at Room 12, Purchasing Dept., City Hall.

The following work has been recommended by the Commr. of Works. Material and estimated cost is as specified. Pavements: Conduit St., brick block, \$13,979; Connaught Ave., asphalt, \$3,375; Humberside Ave., asphalt, \$10,665; Con-

duit St., asphalt, \$8,061; St. Clair Ave., asphalt, \$11,243; St. Clair Ave., asphalt, \$7,244; Balsam Ave., bitulithic, \$16,083; Wellington St., asphalt, \$20,750. Sidewalks: Blythewood Rd., concrete, \$175; Wells St., concrete, \$338; Tennis Cres., concrete, \$332. Grading: Elmer Ave., \$1,887; Beresford Ave., \$3,894; Wheeler Ave., \$14,979. Roadway: Regal Rd., rock, \$11,013; Dufferin St., bitulithic, \$5,895; Dupont St., asphalt, \$19,323; Clifford, asphalt, \$5,642.

Toronto, Ont., Newmarket

Tenders for the erection of a post office and customs house will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until March 30. Plans at the Dept., Postmaster, Newmarket, and Station "F," Toronto.

Toronto, Ont., Leaside

The town council proposes to grade 27 streets at an estimated cost of \$15,000, and construct concrete roads on McRae Drive and Sutherland Drive, at an estimated cost of \$23,705. Clerk, A. T. Lawson.

Vernon, B.C.

A by-law has been carried by the rate-payers to raise the sum of \$4,000 for waterworks extension.

Windsor, Ont.

Tenders will be received by W. A. Hanrahan, Sec. Water Commn., from March 10th until March 27th, for the supply of 500 tons, 6, 8, 10 and 12 in. cast iron water pipe, also valves and hydrants. City Engineer, Ed. Brian.

Welland, Ont.

Tenders will be received by C. M. Webber, Council Clerk, until 4 p.m. March 19th, for the construction of sewers on Fraser, Edward, Queen and Hooker Sts. Plans at the office of the Town Engineer, Welland, and with Hugh C. MacLean, Ltd., 220 King St. W., Toronto.

Woodstock, Ont.

Plans for a sewerage system have been completed by the City Engineer, F. J. Ure, and will be forwarded to the Provincial Board of Health for approval.

Yarmouth, N.S.

The town council is planning to lay 1 mile or more of 12 in. water main this spring.

CONTRACTS AWARDED

Cayuga, Ont.

A contract has been awarded by the Haldimand County Council to Rocmac Roads, Ltd., 74 King St. E., Toronto, for the laying of 26½ miles of roadway.

Frude Mine, Ont.

A contract has been let by the Canadian Copper Co., Copper Cliff, to P. O'Donnel & Co., Sudbury, for the construction of a waterworks pipe line from Whitson Lake.

Kingston, Ont.

The contract for the laying of sheet,

asphaltic and Nepean sandstone block in the railway track allowance on Princess and King Sts., has been awarded to Foley & Gleason, Ottawa, at \$1,319. The work is to be completed in 60 days from commencement.

Montreal, Que.

The contract for the supply of cast-iron pipes has been awarded by the Board of Commrs. to Canada Iron Corporation, Ltd., Mark Fisher Bldg.

North Battleford, Sask.

The following contracts have been awarded by the city council to Canada Foundry Co., King and Simcoe Sts., Toronto, Ont., for hydrants, \$2,000; Kerr Engine Co., Walkerville, Ont., for gate valves, \$1,500; Wm. Kilbride & Co., Calgary, Alta., for concrete construction of sidewalks and curbs; McManus Constr. Co., for extensions to the waterworks system.

Ottawa, Ont.

The contract for the supply of cast iron pipes has been awarded by the City Council to Alex. Fleck, Ltd., 428 Wellington Street.

The following contracts have been awarded by the Waterworks Dept. For the supply of valves, The Kerr Engine Co., Walker Rd., Walkerville, Ont.; for the supply of special castings, Thomas Lawson & Sons, Ltd., 376 Wellington St.; for the supply of brass goods, The Mueller Mfg. Co., River Road, Sarnia.

Preston, Ont.

The contract for asphaltic concrete pavement on Guelph and King Sts., has been awarded by the town council to Foley & Gleason, Ottawa, at \$1.93 per yd.

Wallace Twp., Ont.

The contract for the year's supply of concrete tile pipe has been awarded to G. H. Nickel, Gowanstown.

Railroads, Bridges and Wharves

Arnprior, Ont.

The construction of a railway bridge, over Madawaska River, is being considered by the Grand Trunk Rly. Co.

Calgary, Alta.

A permit for the erection of a temporary engine house at the Parkview Sub.-Div., has been issued to the Canadian Northern Rly. Co.

Edmonton, Alta.

Improvements to Saskatchewan River and the Sturgeon River are contemplated by the Public Works Dept., and the sums of \$50,000, and \$5,000, have been included in estimates.

Fredericton, N.B.

Dist. Engineer, J. K. Scammell, has been instructed to make the necessary surveys for new wharfs, concrete revetment wall, the entire length of the harbor front are to be constructed.

Farnham, Que.

Application for incorporation has been filed by the Farnham & Granby Rly. Co. of Canada. The new company proposes to construct a line from Farnham to Granby, thence to Windsor Mills or Richmond.

Halifax, N.S.

The Public Works Dept. has plans drawn for a draw bridge across the channel of Lennox Passage, crossing Benoit

and Wet Burnt Islands and connecting Isle Madame with the mainland in the county of Richmond. Prov. Engineer, Hiram Donkin.

Kingston, Ont.

It is proposed to extend the Prince Edward & Hastings Rly. to Brighton, a distance of 72 miles.

London Dist., Ont.

The C. P. R. has plans in progress to replace all wooden bridges with steel and concrete structures, at an estimated cost of \$50,000.

Maquapit Lake, N.B.

Tenders for dredging will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. March 17th. Plans and specifications at the Dept., Ottawa.

Meaford, Ont.

The construction of a steel swing-bridge, over the Harbor, is being considered by the town council.

Mill Cove, N.S.

Extensions to the breakwater have been decided upon by the Public Works Dept., and tenders will be received by the Sec., R. C. Desrochers, Ottawa, until March 30th. Plans are at the office of the Dist. Engineers at Halifax and Antigonish, with the Postmaster, Mill Cove, and at the Dept., Ottawa.

Prov. of New Brunswick

Plans, etc., have been filed by the St John & Quebec Rly. Co., with the Registrars of Deeds in the counties of Victoria and Carleton, for a proposed bridge in these counties, over River de Chute and application has been made for approval of plans and site.

Peterboro, Ont.

L. K. Jones, Secretary to the Dept. of Railways and Canals, Ottawa, will receive tenders until March 23rd, for Sec. No. 2, Severn Div., Trent Canal. Plans, etc., at the office of the Chief Engineer, Ottawa, the Dist. Engineer, Midland, Ont., and the Superintending Engineer, Peterboro.

Toronto, Ont.

Tenders will be called shortly by the Board of Control for a masonry and steel superstructure bridge, over the G. T. R. tracks at Strachan Ave.

Tenders will be received by the C. P. R. until March 18th, for excavation, masonry and concrete in connection with double-tracking Humber River Bridge near Lambton. Plans are at Room 605, Union Station. Div. Engineer, A. L. Hertzberg, Room 601, Union Station.

Wallace Twp., Ont.

The construction of a steel bridge is under consideration by the Twp. Council.

CONTRACTS AWARDED

Ainsworth, B.C.

The contract for the construction of the wharf has been awarded by the Pub. Works Dept., to J. Dancy & Co., Nelson, B.C.

Blandford, N.S.

The contract for the breakwater has been awarded by the Public Works Department, to C. A. Strum & Son, Mahoon Bay, N.S.

Caldwell's Cove, N.S.

The contract for the construction of the breakwater has been awarded by the

Public Works Dept., to Whidden & Landry, Antigonish, N.S.

Merrickville, Ont.

The contract for the construction of the dam across Rideau River, has been awarded by the Public Works Dept., to John O'Toole, 233 Rideau St., Ottawa.

Province of Sask.

A contract has been awarded by the C. P. R. to Dutton & Timson, Winnipeg, for the construction of 13 miles of track from Advance southward to Gravelbourg or Mossbank.

Seal Cove, N.B.

The contract for the construction of the breakwater has been awarded by the Public Works Dept., to C. A. Huntley, Grand Man., North Head P.O., N.B.

Victoria, B.C.

The contract for the harbour improvements has been awarded by the Public Works Dept., to Grant Smith & Co., & Macdonnell, Vancouver, \$2,244,745.

Public Buildings, Churches, Schools, etc.

Alvinston, Ont.

A site has been selected for the new Presbyterian Church and a committee has been appointed to inspect different churches and report to the congregation.

Burk's Falls, Ont.

The erection of a post office is being considered by the Pub. Works Dept.

Calgary, Alta.

A dormitory is to be erected by the Calgary University, at an estimated cost of \$250,000.

Cayuga, Ont.

At a meeting of the ratepayers it was unanimously decided that a new school should be built instead of making additions to the old building.

Chatham, Ont.

Messrs. J. L. Wilson & Son, 64 Market Bldg., and Adams & Adams, Reliance Loan Chambers, architects, have been asked to submit designs and estimates for a new wing of 3 storeys to the General Hospital. The estimated cost of the additions is \$30,000.

Cochrane, Ont.

A by-law will be shortly submitted to the ratepayers for authority to raise the sum of \$35,000 for the erection of an 8-room brick school building.

Cooksville, Ont.

Church repairs and addition to the Bethesda Methodist Church are under consideration.

Drumheller, Alta.

The Public School Board will borrow the sum of \$10,000, to fence the school site, build and furnish a school and erect a teacher's residence.

Dunnville, Ont.

Plans are being prepared and tenders are to be called for the erection of a public building at the corner of Broad and Chestnut Sts., at an estimated cost of \$43,000.

The erection of an armoury is being considered by the Dept. of Militia and Defence.

Edmonton, Alta.

The erection of a 3-storey school on Heiminich, is contemplated by the Pub-

lic School Board. Sec.-Treas., M. Brady, Mortlake Blk. Architect, Mr. Turner, Mortlake Blk.

The establishment of stock yards is being considered by the City Council.

A by-law is to be voted on by the ratepayers to raise the sum of \$8,000 for furniture and equipment for the city offices.

Plans are in progress for the erection of a church for the St. Faiths' Church Congregation.

Grande Prairie, Alta.

It is understood that the Methodist Church will erect four small church buildings around Grande Prairie this summer.

Fort Francis, Ont.

It is understood that the town may ask for a donation from the Carnegie Fund for the erection of a public library.

East Garafraxa Twp., Ont.

Tenders for the erection of a school for Section No. 16 will be received by Mr. Jacob Hoare, Amaranth Station, until noon, March 16th. Plans and specifications at the residence of Mr. Hoare and at Inspector Liddy's office, Orangeville.

Harrow, Ont.

The erection of a 2-room high school is being considered by the School Board Trustees.

Hull, Que.

Addition to the court house are proposed, including addition of a new wing, additional rooms for Judges, library, and installation of an elevator.

Humberstone Twp., Ont.

Tenders for the erection of a school for Section No. 4 will be received by Chas. Ort, Welland Jct., Sec., or C. M. Borter, architect, 102 Main St., Niagara Falls, until 6 p.m., March 27th. Plans will be ready by March 12th.

Hamilton, Ont.

Tenders for the erection of the new Y. W. C. A. building, on Main St. W., will be received by Mills & Hutton, architects, 804 Bank of Hamilton Bldg., until March 14th.

Huntsville, Ont.

A post office building will probably be erected by the Public Works Dept.

London, Ont.

Extensive alterations to the collegiate, at a cost of \$25,000, are contemplated by the Board of Education. The work includes remodelling the old building, installing new heating system, re-arranging the rooms, painting and installing new equipment.

East London, Ont.

The Board of Education is considering the erection of a collegiate building of white brick and cut stone construction. Estimated cost \$50,000.

Meaford, Ont.

The town council has received a petition from the citizens asking that a public market be established.

Medicine Hat, Alta.

A site on Central Park has been purchased by the Westminster Presbyterian Congregation, and plans for a new church are to be prepared at once.

The buildings proposals of the public school board include a grade school at

Riverside Park, to cost \$20,000; additions to Alexandra High School, at a cost of \$20,000, and a primary school on Montreal St. to cost \$50,000.

Mirror, Alta.

School Dist. No. 492 will borrow the sum of \$5,000 to complete and equip the school building. Treas., W. C. Gardiner.

Montreal, Que.

Tenders for the erection of a school building on Ottawa St., for the R. C. School Comms., will be received by W. E. Doran, 189 Bleury St., until March 21st. Tenderers must deposit an accepted cheque for 10 per cent. of the contract price.

Montreal, Que. (Lachine)

By-laws are to be submitted shortly providing for the erection of a town hall and incinerator at a cost of \$100,000 and \$30,000 respectively.

Montreal, Que. (St. Lambert)

The erection of a church on Rivermere St. is proposed by the Diocese of Montreal.

Montreal, Que., Rosemount

Bulk and separate tenders received by H. Hardy, 2538 Rosemount Blvd., until March 16th, for the erection of a school building for the School Comms. of St. Francois Solano. Tenders must be accompanied by an accepted cheque for 10 per cent. of the contract price.

Montreal, Que., Westmount

A public meeting will be held on Mar. 14, for the consideration of a by-law to authorize the city to borrow the sum of \$250,000 for the purchase of a site and the erection, furnishing and equipping of buildings, to be used as City Hall, Departmental Offices, Fire Station, Police Station, etc.

Moose Jaw, Sask.

The building of a labor temple is being considered, a company with a capital of \$100,000 having been formed.

The city council has plans in progress for the erection of a fire hall, at an estimated cost of \$25,000, and tenders will be called shortly.

Ottawa, Ont.

A site has been purchased on Arthur St., for the erection of an edifice for St. Lukes Anglican Church (Rector, Rev. W. A. Read, 760 Somerset St.) An architect will be appointed shortly.

A meeting of the Billings Bridge School Trustees will be called shortly to decide whether to build a large addition to the present building or erect a new school.

The purchase of school equipment and furnishings, at a cost of \$11,000, is contemplated by the Public School Board.

Peterboro, Ont.

A site on Brock St., has been purchased by the Black Knights of Ireland Lodge, 137½ Simcoe St., who intend to erect an Orange Hall thereon, at a cost of \$15,000. Further information from Jos. Batten, 189 Simcoe St., or Robt. Wilson, 584 Charlotte St.

Port Arthur, Ont.

Certain additions to the police station are being considered by the city council.

Plans are to be presented for the erection of a county jail, at a cost of \$100,000. Tenders will be called shortly and

contract awarded. Further information can be had from the District Clerk.

The city has voted the sum of \$100,000 towards the cost of erecting the new court house, and has asked the Government for an additional \$25,000, which will be granted when satisfactory plans are submitted to the Public Works Dept.

Raymond, Alta.

The erection of a consolidated school is being considered by the Public School Board.

Regina, Sask.

Plans are being prepared for the erection of a customs house, at a cost of \$200,000, by the Public Works Dept.

The Parks Dept. has decided to place sanitary drinking fountains in all the parks.

Tenders addressed to Duncan C. Scott, Deputy Supt. General, Dept. of Indian Affairs, Ottawa, will be received until noon March 25th, for the construction of 6 residences, 4 stables, 1 office and storehouse building on the Touchwood Hills Agency. Plans, etc., at the Post Offices at Punichy, Canora, Watrous, Melville, Ft. Qu'Appelle, Indian Head and at the land offices at Regina, Saskatoon and Humboldt, and at the Indian Offices at Kutawa, Sask., and at Winnipeg, Man.

Sherbrooke, Que.

The Baptist Church Congregation propose to erect a church building on Queen St., at a cost of \$10,000.

The revised plans for the proposed St. Georges Club House call for a 3-storey, pressed brick, terra cotta, steel and reinforced concrete construction, stone foundation building, estimated cost \$10,000. Architect, H. G. James, 55 Wellington.

Steelton, Ont.

Plans for a school to cost \$20,000 are being prepared by W. B. Redfern for the Corporation of Steelton, and tenders will be received by the Clerk, J. Robinson, from April 20th until May 1st. Tenders are also called from April 15th to May 1st, for school additions, estimated cost \$15,000.

Sudbury, Ont.

A masonic lodge and offices will probably be erected on Elm St., at a cost of \$50,000. It is understood that W. H. Owens, Room 18, Baikie-Gill Block, will draw the plans.

St. Hyacinthe, Que.

The School Comms. are considering the erection of a new building, at a cost of \$50,000, to replace the "Girouard" Academy, recently destroyed by fire.

St. John, N.B.

The erection of a society building, at the corner of Union and Prince William Sts., is being considered by Jos. A. Likely, 9 Garden St.

Stamford Twp., Ont.

A site has been purchased and plans are in progress for a 6-room public school at Lundy's Lane; estimated cost \$25,000. Architect, C. M. Borter, Main St., Niagara Falls.

Smiths Falls, Ont.

Tenders for addition to post office, customs house and armoury will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until March 25th. Plans at the office of the Dept., Post-

master, Smiths Falls, and Station "F," Toronto.

Shawville, Que.

Tenders for the erection of a hall for St. Paul's Church will be received by Sec.-Treas. Jno. H. Shaw, until March 16th.

Souris, Man.

The sum of \$30,000 has been included in the estimates of the Public Works Dept., and it is expected that tenders will be called shortly.

Swift Current, Sask.

Tenders for the erection of an 8-room school building on Elmwood Blvd., will be received by J. T. Dodds, Sec.-Treas., until 5 p.m. March 18th. Architects, Reilly, Dawson, Hancock & Reilly, 512 Westman Chmbrs., Regina.

Thorndale, Ont.

It is proposed to erect a church at a cost of \$7,000, for the Anglican Congregation. Architects, McBride & Gilbert, Edge Block, Landon.

Timmins, Ont.

The council has passed a by-law issuing debentures, \$10,000, for new public school. The plans will call for a four-room building of brick construction.

Tofield, Alta.

The town council proposes to erect a hospital building at a cost of \$4,200.

Toronto, Ont.

Tenders will be received by the chairman, Board of Control, until March 17th, for masonry, carpentry and metal work, plumbing, heating, wiring and light fixtures, plastering and painting, in connection with the Island police station. Plans, etc., at the office of the City Architect.

Plans for the erection of a church, on Harvey St., for the St. David's Pres. Church Congregation, are being prepared by H. G. Paull, architect, 395 College street.

The Board of Education has extended the time for receiving tenders on masonry, structural steel, and ash hoist at Harbord St. School, and for carpentry, plastering, painting and plumbing at Connaught School, to March 13th.

Tenders will be received by Ellis & Connery, architects, Manning Chmbrs., until March 14th, for an addition of 4 rooms to Prince George School, and for an addition of 4 rooms to George Symes School.

Funds are to be raised for the erection of a Sunday school for the High Park Ave. Methodist Church. Estimated cost \$50,000.

The erection of a school, at a cost of \$75,000, is being considered by School Sec. No. 26, York. Sec., W. H. Bessey, 26 Enderby Rd., Toronto. The location has not been definitely decided.

Toronto, Ont., Todmorden

Plans are being prepared for the erection of a school building, to cost \$90,000. Tenders will be called about the middle of April.

Trochu, Alta.

The Separate School Dist. No. 20, will borrow the sum of \$6,000 for the erection of a school building.

Verulam Twp., Ont.

Tenders will be received by Sec. S. S. No. 2, J. B. Kennedy, Dunsford, Ont.,

until March 15th, for the erection of a brick school building for school Sec. No. 9.

Vernon, B.C.

A by-law authorizing certain improvements to the city hall, at a cost of \$5,000 has been carried by ratepayers.

Walkerville, Ont.

Plans for a church similar to Leamington Methodist Church are being prepared for the Lincoln Rd. Methodist Congregation. The seating capacity will be 1,200, and the cost is estimated at \$35,000. Architects, Smith & Walker, Excise Bldg.

Windsor, Ont.

By-law authorizing the expenditure of \$70,000 on the erection of a market building are to be prepared and presented to the ratepayers for approval.

CONTRACTS AWARDED

Brantford, Ont.

The contract for the construction of the mausoleum for the Dominion Mausoleum Co., at Mt. Hope Cemetery, has been awarded to P. H. Secord & Son, 133 Nelson St. Work will be commenced in about two months' time.

Chicoutimi, Que.

The contract for the erection of the Convent for Le Seminaire de Chicoutimi has been awarded to the Morissette Co., Quebec.

Cobalt, Ont.

The contract for post office fittings has been awarded by the Public Works Dept., to Oshawa Interior Fittings Co., Oshawa, Ont.

Fort William, Ont.

The sub-contract for stone in connection with the erection of the customs house has been let to Wallace Sandstone Quarries, Ltd., 120 St. James St., Montreal.

Montreal, Que., Longue Pointe

The general contract for the erection of the fire station has been awarded to T. Lessard, 205 St. James Et., who has sub-let the following: Carpentry, T. Bernard & Fils, 1280 Erables St.; steel, Dom. Bridge Co., Lachine; roofing, heating and plumbing, J. J. Baird, 1277 St. Dominique, and plastering, A. Morache, 499 St. Andre, and painting, F. X. Bernard, c/o General Contractor; electrical, J. A. St. Amour, 1281 De St. Valier street.

Port Arthur, Ont.

The sub-contract for stone in connection with the erection of the customs house has been let to Wallace Sandstone Quarries, Ltd., 120 St. James St., Montreal.

St. Antoine de Richelieu, Que.

The following contracts have been awarded in connection with the erection of the new church for the Catholic Church Trustees. General contractors, carpentry and interior fittings, Paquet & Godbout, St. Hyacinthe; mason and plastering, Theo. Halley, St. Hyacinthe; steel, Phoenix Bridge & Iron Works, Ltd., 83 Colborne St., Montreal; roofing, heating and plumbing, Ls. Moge, St. Antoine. Architects, Gauthier & Daoust, 180 St. James St., Montreal.

St. Pierre du Lac, Que.

The contract for the erection of a church, on Cedar Hall, for the R. C. Denomination has been awarded to Y. Cou-

ture, 18 St. Joseph St., Levis, at \$67,500. This does not include interior finish. Architect, Rene Lemay, 21 D'Aiguillon St., Que.

Toronto, Ont.

The contract for heating, plumbing and ventilating at St. Helens School, has been awarded to W. J. McGuire, 86 King W., \$13,300.

The contract for heating, plumbing and ventilating at St. Cecillas School, has been awarded to P. J. Hayes, 1245 Queen W., \$6,605.

Victoria, B.C.

The contract for the erection of the school building on Beacon Hill, has been awarded to Luney Bros., Ltd., Room 508 Sayward Bldg., \$17,490.

Business Buildings and Industrial Plants

Drummondville, Que.

The O. B. Shoe Co., Ltd., propose to erect a factory at a cost of \$120,000, to replace the building recently destroyed.

Edmonton, Alta.

The Dixon Steel & Bridge Co. has secured water rights at Manchester subdivision, and will erect a plant for the manufacture of steel, bridges, etc.

Guelph, Ont.

Plans are being prepared for the erection of a factory for Sherer & Gellett, Mfrs. Clean Food Counters, Chicago, Ill.

Hamilton, Ont.

The erection of 2 stores and apartments, on York St., to cost \$12,000, is being considered by the Goldberg Realty Co., Lister Chmbrs. Architect, J. D. Corrigan, 231 Catharine N.

Plans are in progress for extensions to the factory of the Willys-Overland Auto Co.

Harriston, Ont.

Gunns, Ltd., Gunn's Rd., Toronto, are considering the erection of poultry buildings on Margaret St.

London, Ont.

J. W. Scandrett, Richmond and College Ave., contemplates building a sun parlor, garage, wall and pagoda. Architect, McBride & Gilbert, Dundas and Richmond Sts.

Plans are being prepared for cold storage plant, for Silverwood's, Ltd., Bathurst St. The plant is to be worked by 500 V.A.C. three-phase motors (150 h.p.)

Medicine Hat, Alta.

Plans are being prepared for artificial ice plant and skating rinks, to cost \$100,000, for the Medicine Hat Pure Ice Co. Provision will be made for 150,000 ft. cold storage space.

Montreal, Que.

The Robinson Oliver Grain Co., Board of Trade Bldg., are looking for a site on which to build a new warehouse.

New tenders for alterations to warehouse, on Jurors St., for Adam Beck & Co., are invited by Hutchison, Wood & Miller, architects, Royal Ins. Bldg.

A permit for alterations to dairy, to cost \$6,000, has been granted to J. J. Joubert, Ltd., 975 St. Andre St.

Plans for a winter tennis court, to cost \$25,000, have been drawn for a private

syndicate, by Harold E. Shorey, architect, 56 Beaver Hall Hill, who will call for tenders immediately.

Montreal, Que., Westmount

The council has refused to issue a permit to D. Harrison, for the erection of stables, at a cost of \$50,000. The matter will be brought up again in the near future.

Moose Jaw, Sask.

Plans are in progress and tenders will be called in the spring for a bank building on Main St., for the Bank of Nova Scotia. Architect, R. G. Bunyard, Hammond Bldg.

Napanee, Ont.

James Foster, Prop. of "The Wonderland," has purchased a site on Dundas and West Sts. for the erection of an opera house.

Nelson, B.C.

Plans for the erection of stores and offices, to cost \$20,000, have been prepared for Carmen Maglio.

Orillia, Ont.

A by-law will be submitted to ratepayers on March 30th, to sanction loan of \$50,000 to J. R. Eaton & Sons, Ltd., for the erection of a woodworking factory. Estimated to cost \$100,000.

Preston, Ont.

Chas. E. Fischer, King St., Waterloo, Ont., has purchased the opera house block and will spend about \$25,000 in enlarging the building and erecting stores.

Pt. Coquitlam, B.C.

The city council has approved of the Smith-Davidson Flour Mills & Elevator Co.'s plans for new premises.

Regina, Sask.

A site for the erection of a warehouse has been secured by the Independent Tire Co., Galt, Ont. Estimated cost \$10,000.

Sault Ste. Marie, Ont.

Plans are in progress for the erection of 2 stores and flats on Gore and Albert Sts., for G. E. Carniel, 137 Tancard St., at a cost of \$10,000.

The erection of stores on Queen St., at a cost of \$10,000, is contemplated by Walter Bros. Architect, R. Murdock.

Sherbrooke, Que.

Nothing will be done with regard to the erection of the proposed Can. Bank of Commerce office building, until the spring of 1915.

Plans are in progress for the erection of a stores, offices and apartments building, on King St., to cost \$16,000, for Pierre Gauvin. Architect, F. X. Lefebvre, 119 Wellington St.

Sudbury, Ont.

Mr. Stafford proposes to erect a store and apartment building on Durham St., at a cost of \$50,000.

Steelton, Ont.

The construction of open hearth furnaces are contemplated by the Algoma Steel Corp., Ltd., Wilde Ave., Sault Ste. Marie, and tenders will be received after May 1st. The specification calls for Brick, steel and hollow tile construction, brick and concrete foundation, corrugated iron roofing, electric lighting, temperature regulators, concrete and fireproof floors, metal lath, sash and ceilings, wire glass, 1 freight elevator, sky-

lights, ventilators, fireproof doors, architectural iron railings and stairs, coal conveying and hoisting machinery, boilers, blowers, stacks, pumps, air compressors, gas engines, motors, cranes.

Stratford, Ont.

The ratepayers have recently passed the following factory by-laws: (1) Granting a fixed assessment of \$7,500 to the Stratford Mfg. Co., Ltd., who are about to extend their factory; (2) Granting \$3,500, a site, and fixed assessment to Chas. Diebel, of Hanover, who proposes to erect a furniture frame factory, and (3) granting \$2,500, a site, and fixed assessment to John S. Morlock for the erection of an upholstering factory.

St. John, N.B.

The Imperial Tobacco Co., Ltd., 900 St. Andrew St., Montreal, has secured a site for the erection of a storage building.

St. Thomas, Ont.

Minshall & Boyd, of the Star Theatre, propose to erect a theatre, at a cost of \$30,000.

Timmins, Ont.

Plans are to be prepared for the erection of a bank building on 3rd Ave. and Pine St., for the Imperial Bank of Canada, estimated cost \$10,000.

The Canadian Mining Finance Co. have plans in progress for the erection of a building to be used for a roller rink during summer. Seating capacity, 2,000. The equipment includes roller skates, military band organ, baths for hockey dressing rooms, etc. Estimated cost \$30,000.

Tillsonburg, Ont.

E. J. House is considering the erection of a skating rink at a cost of \$7,000.

Tisdale, Sask.

It is understood that the Tisdale Trading & Knitting Co. will establish a plant here.

Toronto, Ont.

Tenders for the erection of 3 stores on St. Clair Ave., will be received by W. H. Mallory, 31 Queen W., until March 14th.

H. J. Atkinson, 34 St. Andrews Gardens, will receive tenders for stone masonry in connection with 6 stores on St. Clair Avenue, near Lansdowne Avenue.

Tenders are invited by F. H. Herbert, 65 Adelaide E., until March 13th, for all trades except heating and plumbing, on a 5-storey warehouse at the corner of Church and Lombard Sts., for Cluff Bros.

Plans have been drawn for a 1-storey addition to the factory of McGregor & McIntyre, 1139 Show St.

Plans are being prepared for the erection of a hall, etc., at the corner of St. Clair Avenue and Elmwood Avenue, for Jas. Manchester, 1632 Dufferin St. Architect, L. Foulds, 21 Leader Lane.

Viking, Alta.

The Viking Co-operative Creamery Co. has certain additions under consideration. The plans include the installation of new machinery and a 600 gal. Simplex churn.

Vancouver, B.C.

The Canadian Carbonate Co., Ltd., (Mrs. Carbonic Acid Gas), Hadley St., Montreal, Que., are looking for a suitable factory site.

Tenders for a laundry building, to cost \$40,000, on Beach Ave. and Howe St., for the Cascade Laundry, 848 Beach Ave., are invited by Chas. Benthall, architect, 1215 Jervis St.

Winnipeg, Man.

Tenders for interior alterations to Bank of British North America, Main St., are being received by Pratt & Ross, St. Rly. Chmbrs., Architects.

Windsor, Ont.

The town has passed by-laws granting certain exemptions to The Dowsley Spring and Axle Co., who will erect a 60 ft. by 150 ft., 1 storey factory; The Central Ice & Storage, for the manufacture of artificial ice; and to The Ideal Concrete Machine Co., who will erect a small plant.

Yarmouth, N.S.

The Consumers Fish Co. are considering the installation of a small sized refrigerator and cold storage plant.

CONTRACTS AWARDED

Calgary, Alta.

The contract for alterations to the store and office building of C. Traunweiser, 122a 8th Ave. W., has been awarded to A. A. Rose, David Block.

Coaticook, Que.

The contract for the erection of stores and tenements on Child St., for B. J. Smith, has been awarded to I. Grenier, c/o Owner, Compton street.

Elmira, Ont.

The following contracts have been awarded in connection with the erection of the Metropolitan Bank. General contractor and mason, C. Wilken, Elmira; carpentry, Jacob Foerster; roofing, heating and plumbing, F. Rudow.

Hamilton, Ont.

The following additional contracts have been awarded on the 3 stores and apartments being erected on Barton St. E., for W. R. Turnbull. General contractor, Geo. E. Mills, 614 King E.; plastering, Hannaford Bros., 232 Robinson St.; painting, J. Dorking, 17 Ferguson St. N.

Montreal, Que.

The contract for steel in connection with the erection of the Sun Life Assurance Co. office building, has been awarded to the Dom. Bridge Co., Lachine.

Ottawa, Ont.

The contract for electrical fittings at the Capital General Trust Co., Sparks street, has been let to J. H. Byrnes, 86 Henderson.

Sandwich, Ont.

The contract for repairs to the Home Bank of Canada Bldg. has been let to Judson McLean.

Sarnia, Ont.

The contract for concrete work at the banking office and apartments building of The Industrial & Mortgage Savings Co., has been awarded to F. Gutteridge Co.

Toronto, Ont.

The following contracts have been awarded in connection with the erection of the warehouse on 120 Richmond W., for D. Fitzgerald. Architects, Chadwick & Beckett, 18 Toronto St.; mason, Jas. A. Wickett, Ltd., 28 Toronto St.; carpentry, J. E. Almond, 78 Constance

St.; plastering, T. Gander & Son, 251 Gladstone St.; steel, Hepburn & Disher, 18 Van Horne St.; plumbing, Callis, Shephard & Abbott, 25 Albertus Ave.

Residences

Chicoutimi, Que.

Simon Gagne proposes to erect a 4-storey brick residence on Du Hoire St., at a cost of \$5,000.

Guelph, Ont.

B. Scott is about to erect a brick residence on Horne St., at a cost of \$7,500.

Edmonton, Alta.

Plans are prepared for an apartment house on Saskatchewan Ave., for R. E. Foote, 208 6th St., at an estimated cost of \$25,000, an additional section will be erected later.

East Hamilton, Ont.

The erection of 14 brick residences is being considered by H. McCann, 98 Wilson street.

Kingsville, Ont.

W. H. Noble has purchased a site for the erection of a residence.

Knowlton, Que.

Wm. Scully, 320 University, Montreal, contemplates building a \$10,000 summer residence on the site of that recently destroyed by fire.

London, Ont.

N. F. Willmot, 771 Waterloo St., proposes to erect a red pressed brick residence on Colborne St., at a cost of \$8,000.

J. C. Mottoshed, 569 William St., has plans in progress for the erection of 20 small brick residences.

Frank Cody, 71 Shanley St., is about to erect two red pressed brick residences on Becher St., at a cost of \$9,000.

Montreal, Que.

Tenders are invited for the erection of a residence on Edgehill Ave., for Mr. Ouimet. Architects, Asselin & Brosseau, Imp. Theatre Bldg., Bleury St.

A permit for 9 flats, to cost \$10,000, on Cartier St., has been issued to B. Bailargeon, 1652 Des Erables.

The date for tendering on alterations to several apartments on Lincoln St., for Jno. S. Prince, has been changed to March 15th.

Montreal, Que., Notre Dame de Grace

Robt. Neville, Jr., 933 Rockland Ave., Outremont, is now open for tenders on brick, roofing, plastering, painting, heating, plumbing and electric, on 7 residences on Hampton St. Total cost \$70,000.

Sub-tenders are invited for carpentry, etc., on 50 cottages, being erected on Westhill Ave., by Henry Gaffney, 204 St. James St.

Montreal, Que., Rosemount

P. H. Richardson & W. D. Chambers, 299 St. James St., are still open to receive tenders on 50 flats on 43rd Ave., and 20 residences on 2nd Ave., estimated to cost \$200,000 and \$80,000 respectively.

Montreal, Que., St. Laurent

Henry Gaffney, 204 St. James St., has under consideration the erection of 6 residences.

Ottawa, Ont.

Plans for a residence on Clemow St., for C. E. Fleming, have been drawn by

Weeks & Burgess, architect, Citizen Bldg. Estimated cost \$6,500.

The erection of a residence on Powell St., to cost \$5,000, is contemplated by Owen O'Reilly, 320 Bay St.

Wm. McCracken, 245 Powell, proposes to erect a residence at a cost of \$5,500.

Sherbrooke, Que.

Plans for a residence, to cost \$8,000, are being drawn for Jno. F. McDonald, by H. G. James, Wellington St.

Plans are in progress for the erection of a \$7,000 residence on Victoria St., for Jno. MacDonald, Quebec St. Architect, H. G. James, Whiting Block, Wellington street.

Sudbury, Ont.

W. H. Owens, architect, Room 18, Baikie-Gill Block, is drawing plans for a \$5,000 residence on Cedar St., for Mr. Fintzel, and a \$7,500 residence on Elm St., for Sheriff Irving.

Toronto, Ont.

The Toronto Housing Co., Continental Life Bldg., will receive tenders until March 19th, for all trades in erection of 86 flats (seven buildings). Plans, etc., at the new office of the company, Ryrie Bldg.

Plans for the erection of ten residences on Davenport and Christie Sts. are being prepared for W. Marks, 37 Yarmouth Gardens.

Plans for three pair of residences on Nassau street to cost \$12,000, have been drawn for Caplan Bros. and J. Layevsky.

Plans for alterations to apartments situate at 176-8 Wilton have been drawn by J. H. Galloway, architect, 23 Toronto St., estimated cost \$6,000.

Winnipeg, Man.

Naidanac Builders Corp., 434 Somerset Bldg., contemplate building a large number of residences during 1914.

Plans are in progress for the erection of a \$30,000 apartment block on Sherbrooke St. for E. M. Counsell, McGreevy Bldg. H. M. Greene, architect, McGreevy Bldg. Tenders will be called immediately.

Power Plants, Electricity and Telephones

Brockville, Ont.

A draft agreement has been drawn between the Morrisburg Electric Railway Co. and the Town Council for a 21-year franchise.

Bassano, Alta.

The time for receiving tenders for the supply and construction of a telephone line has been extended to March 20. Plans and specifications are at the office of the Consulting Engineers, Jno. Galt Engineering Co., Ltd., 233 Judge Travis Bldg., Calgary.

Calgary, Alta.

The Council will recommend expenditure of \$300,000 on extensions to the electrical plant.

Govan, Sask.

Tenders will be received by Tracy Wallbridge, Sec. Govan Telephone Co., until April 5th, for the construction of the Wessels Rural Telephone system.

Kincardine, Ont.

It is proposed to install underground conduits for a new street lighting system for which new wiring will be required.

Posts to be of augmented cement or cast iron. Further information from Andrew Ingram, Kincardine.

Lambton County, Ont.

The chairman of the Ontario Hydro Commission has ordered surveys to be made for a radial line through Dawn and Euphemia townships.

Ottawa, Ont.

The government is considering a subsidy to the Ottawa & St. Lawrence Railway Co. for a line passing the rifle ranges. Work is to commence this spring.

Regina, Sask.

Tenders for the erection of a power house, to cost \$100,000, will be received by Commr. L. A. Thornton, until March 25th. Architects, Storey & Van Egmond, 1014 McCallum Hill Bldg.

Sutherland, Sask.

A committee has been appointed to look into the question of the installation of a power plant, and will report shortly to the town council.

St. John, N.B.

Plans for the construction of a car barn on Wentworth St., for the St. John Street Railway Co., Ltd., are being drawn. Concrete foundation, brick construction. Architect, H. C. Mott, 13 Germain street.

Sarnia, Ont.

The town council is to consider the question of extensions to the street railway at their next meeting.

Vernon, B.C.

A by-law authorizing extension to electric lighting at a cost of \$11,000, has been carried by the ratepayers.

Woodstock, Ont.

The erection of a telephone exchange is being considered by the Bell Telephone Co. of Canada, Ltd.

CONTRACTS AWARDED

Montreal, Que. (Outremont)

A contract has been awarded by the Town of Outremont to Eugene Phillips, Electrical Works, De Gaspe Ave., for the supply of stranded conduit cables for underground conduits, price \$17,170. General contractors, Imperial Wire & Cable Co., 241 Guy St., Montreal, for terminals for standard lamps, price \$3,150.

Windsor, Ont.

The contract for wiring and electrical fixtures at the post office has been awarded by the Public Works Dept., to the Dominion Electric Co., 4 Pitt St. W.

CASTINGS

Gardner & Saxby

Engineers' Patternmakers, etc.

346 5th Ave. W., Vancouver, B.C.

Arthur L. Weeks

Architect

Canada Life Building, Ottawa

Reinforced concrete and steel structures, factories and commercial buildings

Tenders and For Sale Department

Notice to Contractors

Vitrified Clay Pipe

Sealed tenders addressed to the Chairman and Members of the Board of Control will be received by the Secretary of the Board of Control, City Hall, Ottawa, up to 4 p.m., Tuesday, March 31st, 1914, for the supply and delivery of "Vitrified Clay Pipe."

Specifications, form of tender and full particulars may be obtained on application at the City Engineer's office, City Hall, Ottawa.

Any tender received after the above stated time will be declared informal.

The Corporation does not bind itself to accept the lowest or any tender.

ARCH. CURRIE,

City Engineer.

Ottawa, March 6th, 1914.

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Department of Railways and Canals, Canada

Trent Canal Section 2, Severn Division

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Section No. 2, Severn Division, Trent Canal," will be received at this office until 12 o'clock noon on Monday, March 23rd, 1914.

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa; at the office of the Superintendent Engineer, Trent Canal, Peterborough, Ont.; and at the office of the District Engineer, Public Works Department, Midland, Ont.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence, of each member of the firm.

An accepted bank cheque on a chartered bank of Canada, for the sum of \$36,000, made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque thus sent in will be returned to the respective contractors whose tenders are not accepted.

The cheque of the successful tenderers will be held as security, or part security, for the due fulfillment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,

Asst. Deputy Minister and Secretary.

Department of Railways and Canals,
Ottawa, February 25th, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—56425. 9-10



Tenders for Annual Supplies

Department of Works

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Canada, up to noon on Tuesday, March 17th, 1914.

Paving Blocks Vitrified

Specifications and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section, of the Department of Works, City Hall, Toronto.

Envelopes containing tender must be plainly marked on the outside as to contents.

The usual conditions relating to tendering as prescribed by City By-law, must be strictly complied with, or the tenders may be declared informal.

Tenderers shall submit with their tenders the names of two personal sureties, approved by the City Treasurer, or in lieu thereof, the bond of a Guarantee Company approved as aforesaid.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,

Chairman, Board of Control.

City Hall, Toronto,

March 3rd, 1910.

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Sealed tenders addressed to the undersigned and endorsed "Tender for Addition and Alteration to Public Building, Smith's Falls, Ont., will be received at this office until 4 p.m., on Monday, March 25, 1914, for the work mentioned.

Plans, specification and form of contract can be seen and form of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Smith's Falls, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,

Secretary.

Department of Public Works,

Ottawa, March 3, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—53010. 10-11

CANADIAN PACIFIC RAILWAY COMPANY
DEPARTMENT OF NATURAL RESOURCES

ENGINEERING BRANCH

TENDERS FOR TIMBER STRUCTURES

Sealed tenders, addressed to the undersigned and endorsed "Tenders for Timber Structures," will be received up to noon of March 14th, 1914.

The work to be let includes the timber (Irrigation) structures in about half the area of the Eastern Section of the Company's Irrigation Block in Alberta.

Approximate quantities are 3,550,000 feet B.M. of timber and 18,000 cubic yards of excavation. All construction materials will be furnished by the Railway Company.

Plans, specifications and full information will be furnished on application to the undersigned. A deposit of \$50 will be required before plans, etc., will be given out, which will be refunded on their return in good condition.

All proposals must be accompanied by a certified cheque, payable to the undersigned, for five per cent. (5 p.c.) of the amount of the tender, to be forfeited as liquidated damages should the bidder neglect or refuse to enter into a contract if the work is awarded to him.

All proposals must be made on the standard form provided or they will not be considered. Any alterations thereto, interlineations or qualifying of prices may invalidate the proposal.

The right is reserved to reject any or all bids and to waive defects.

A. S. DAWSON,

Chief Engineer.

Calgary, Alberta.

8-10



Tenders

Tenders addressed to the undersigned at Ottawa and marked on the envelope "Tender for Illuminating Oil and Oil for Kerosene Engines," will be received up to noon of the Twenty-eighth day of March, 1914, for the supplying and delivering about 150,000 gallons of Illuminating Oil and about 50,000 gallons of Oil for Kerosene engines, both made according to the specifications prepared by the Department of Marine and Fisheries.

The quantities mentioned herein are only estimates and the Department reserves the right to order larger or smaller quantities as required.

Specifications and forms of tender can be procured from the Collectors of Customs at Toronto, Petrolia and Sarnia, and from the Agents of this Department at Montreal, Quebec, St. John, Halifax and Charlottetown, and also from the Purchasing and Contract Agent, Marine Department, Ottawa.

Each tender must be accompanied by a deposit cheque equal to five per cent. of the total amount of the tender.

All tenders must be made on the tender form prepared by the Department.

No tender will be considered except for oil strictly in accordance with the specifications and put up in packages as called for in said specifications. Samples of the oils, cans and cases must be submitted.

The Department reserves the right to accept the whole or any part of a tender.

The lowest or any tender not necessarily accepted.

Newspapers copying this advertisement without authority will not be paid for same.

A. JOHNSTON,

Deputy Minister of Marine and Fisheries.
Department of Marine and Fisheries,

56784

Ottawa, 16th February, 1914. 10-12

Time Extended

Tenders will be received by the undersigned until 5 p.m., **March 6th, 1914**, for all trades required in connection with the erection and completion of a new Public School Building to be erected in the Town of Welland. Plans and specifications may be seen at the office of the Contract Record, Toronto, Mr. J. McCaw, Secretary, Public School Board, Welland, Ont., and A. E. Nicholson, Architect, 46 Queen Street, St. Catharines, Ont.

The lowest or any tender not necessarily accepted.

A. E. NICHOLSON, O.A.A., Architect,
46 Queen St., St. Catharines, Ont.

Time for receiving tenders for the above school is hereby extended to **March 20th, 1914**, at 6 p.m.
10 A. E. NICHOLSON.

Tenders Sewers

Tenders will be received by Mr. C. M. Webber, Town Clerk, Welland, Ont., up to 4 p.m. on **Thursday, 19th inst.**, for the construction of the following sewers:

Fraser Street, 18 in. diam., greatest depth 16 ft. 8 ins.

Edward Street, 12 inch diam., greatest depth 12 feet.

Queen Street, No. 2, 12 inch diam., greatest depth 12 feet.

Queen Street, No. 1, 10 inch diam., greatest depth 11 ft. 7 ins.

Hooker Street, 10 inch diam., greatest depth 11 ft. 7 ins.

Plans and specifications may now be seen at office of Contract Record, 220 King Street West, Toronto. Plans may be seen, specifications and all other information received at office of Town Engineer, Welland.

Each tender must be accompanied with a certified cheque valued at 10 per cent. of total cost. Tenders delivered after above hour and date for receiving shall be disqualified.

The Council do not bind themselves to accept the lowest or any tender.

By order of the Sewer Committee,

JAS. HUGHES, Chairman.

Engineering Department,
Welland, March 6th, 1914.

10



Sealed tenders addressed to the undersigned and endorsed "Tender for Public Building, Newmarket, Ont.," will be received at this office until 4 p.m., on **Monday, March 30, 1914**, for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Newmarket, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,

Secretary.

Department of Public Works,
Ottawa, March 5, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department—56788.

10 11

Tenders for Flats

Tenders (all trades) for the erection of 86 cottage flats, comprising seven buildings, will be received by The Toronto Housing Company, Limited, up to and including **Thursday, March 19**. Plans and specifications may be secured at the company's office, Ryrie Building, Yonge and Shuter streets, on and after Monday, March 9.

10

Notice

CITY OF SWIFT CURRENT

Sealed tenders, endorsed on envelope "Tenders for Cast Iron Pipe," "Tenders for Steel Pipe" or "Tenders for Gate Valves and Hydrants," as the case may be, will be received by the undersigned up to 5 o'clock p.m. of **Monday, April 13th, 1914**, for the supply and delivery F.O.B. Swift Current, Sask.:

Contract "A-4"
246 Tons Cast Iron Pipe of various sizes.
7 Tons Cast Iron Pipe of Special Castings.

Alternative:

12000 lin. feet of 6-in. Steel Pipe.
1000 lin. feet of 8-in. Steel Pipe.

200 lin. feet of 10-in. Steel Pipe.
Specials of various sizes.

Contract "B-4"

44 6-in. Gate Valves and Boxes.
8 8-in. Gate Valves and Boxes.

20 Fire Hydrants.

Specifications and forms of tender may be obtained on application to the City Engineer, Swift Current.

A marked cheque for an amount equal to five per cent. of the contract is required as a deposit.

The lowest or any tender not necessarily accepted.

GEO. D. ARNOTT,
City Clerk.

Corporation Offices,
Swift Current, Feb. 28, 1914.

10-12

Tenders Wanted

Separate tenders addressed to Euclide Jacques, Esq., Chairman, Water Commissioners, Windsor, Ontario, and marked "Tender," will be received by the undersigned up to 12 o'clock noon, on **Wednesday, March 31st, 1914**, for:

(a) 450 tons (more or less) of cast iron water pipe, size from 6-in. to 10-in.
100 tees, and 20 crosses.

According to standard specifications adopted by Canadian Society of Civil Engineers.

(b) 8 8-in. valves.
35 6-in. valves.
50 extension valve boxes, 5 ft. in length.

(c) 75 fire hydrants to bury 5 ft., having 6-in. barrel with two 2½-in. and one 4-in. steamer connection.

(d) 10 tons pig lead.
All of above to be delivered f.o.b. cars Windsor.

All pipe must be tested to 300 lbs. before leaving the factory. A certificate of test must be furnished in accordance with the terms of Section 16: No outside weights will be accepted.

A certified cheque payable to the order of the Water Commissioners equal to 5 per cent. of the amount of the tender must accompany each tender, which cheque in the case of an unsuccessful tenderer will be forthwith returned, but in the case of the successful tenderer, will be retained until a satisfactory bond for the due performance of the work is executed, or if such successful tenderer for any reason neglects or refuses to execute a satisfactory bond within 15 days after notice that his tender has been accepted by the Water Commissioners, said cheque will be cashed, and the expense of re-advertising the work required, and any additional cost in connection with the same over the amount of his tender, will be retained from the proceeds of such cheque.

The right is reserved to reject any or all tenders.

THE WATER COMMISSIONERS,

W. A. Hanrahan, Secretary.

Windsor, Ont.
March 6th, 1914.

10-11

Tenders Wanted

Tenders will be received by the Council of the Township of Hullett up to 3 p.m. on **Friday, March 27th, 1914**, for the digging and construction of the Bowes Award Drain in the Townships of Hullett and Morris.

Plans and specifications can be seen at the Township Clerk's Office, Londesboro, Ont.

The lowest or any tender not necessarily accepted.

JAMES CAMPBELL,
Township Clerk.

10-11

TOWN OF HUMBOLDT PROVINCE OF SASKATCHEWAN

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer until 8 p.m., **Wednesday, April 15th**, for the following works:—
Contract "A"—Labor Laying Water Mains and Sewers.

Contract "B"—Pump House and Filter House.

Contract "C"—Furnishing Material for, and Erecting Water Towers.

Contract "D"—Furnishing Cast Iron Water Pipes.

Contract "E"—Furnishing Fire Hydrants and Valves.

Contract "F"—Furnishing and Installing Pressure Filters.

Contract "G"—Furnishing and Installing Pumping Machinery.

Contract "N"—Furnishing wood Stave Pipe.

Contract "O"—Laying Wood Stave Pipe.

Contract "P"—Constructing Ejector Station.

Contract "S"—Furnishing Sewer Pipes.

Contract "X"—Constructing Sewage Disposal Works.

Plans and specifications may be seen at the office of the Engineers, Toronto and Winnipeg, and at the Town Hall, Humboldt, on and after **March 16th**.

No tender necessarily accepted.

W. H. STILES, Esq., Sec.-Treasurer,

O. W. ANDREASEN, Esq., Mayor,

CHIPMAN & POWER, Engineers. 9-11



Tenders For Police Station at The Island

Bulk tenders, or tenders for the several trades mentioned below in connection with the above building, will be received by registered post only, addressed to the undersigned, up to noon on

TUESDAY, 17th MARCH, 1914.

1. Mason work.
2. Carpenter and metal work.
3. Plumbing, Heating, Electric Wiring and Light Fixtures.
4. Plastering.
5. Painting.

Plans and specifications may be seen and forms of tender and all information obtained at the office of the City Architect, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. The usual conditions relating to tendering as prescribed by city by-laws must be strictly complied with or tenders may not be entertained. Tenderers shall submit with their tender the names of two personal sureties or the bond of a guarantee company approved by the City Treasurer. The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor.
City Hall, Toronto, March 4, 1914.

10

Tenders for Pavement

Sealed tenders addressed to the undersigned will be received up to 6 o'clock p.m., Monday, March 23, 1914, for the excavation, Concrete Base and Wearing Surface of either of the following pavements: Asphaltic Concrete, Cressed Wood Block or Bitulithic. Plans and specifications for the above work may be seen, and all other information obtained at the office of the City Street Surveyor at City Hall, Belleville. Approximate amount of Pavement 18,000 square yards.

The Pavement to be selected will depend to some extent on price. The lowest or any tender not necessarily accepted.

Dr. E. O. PLATT,
Chairman of Public Works,
1 Catharine Street,
Belleville, Ont.

10



Tenders

Sealed tenders addressed to the Secretary of the Department of the Interior, Ottawa, Ont., and marked "Tenders for Steel Water Pipe, Banff," and "Tenders for Cast Iron Water Pipe, Banff," will be received up to noon, April 6th, 1914, for the supply of:—

(a) Thirteen thousand five hundred (13,500) lineal feet of twenty-inch diameter lapwelded steel pipe, and (b) Twelve thousand (12,000) lineal feet of six-inch diameter cast iron pipe for the water system at Banff, Alta.

Specifications may be had from the Commissioner of Dominion Parks, Ottawa, Ont., The Chief Superintendent of Dominion Parks, Edmonton, Alta., The Superintendent, Rocky Mountains Park, Banff, Alta.

The lowest or any tender not necessarily accepted.

The unauthorized insertion of this advertisement in any newspaper will not be paid for.

LYNDWODE PEREIRA,
Secretary.

Department of the Interior,
Ottawa, Ont. —56134. 9-10



Tenders For Police Station on Davenport Road

Bulk tenders, or tenders for the several trades mentioned below in connection with the above building, will be received by registered post only, addressed to the undersigned, up to noon on Tuesday, March 17th, 1914:—

1. Mason work.
2. Carpenter work.
3. Roofing.
4. Plumbing, heating, electric wiring and light fixtures.
5. Plastering.
6. Painting.
7. Stable-fittings.
8. Tiling.

Plans and specifications may be seen and forms of tender and all information obtained at the office of the City Architect, City Hall, Toronto. Envelopes containing tenders must be plainly marked on the outside as to contents. The usual conditions relating to tendering as prescribed by city by-laws must be strictly complied with or tenders may not be entertained. Tenderers shall submit with their tender the names of two personal sureties or the bond of a Guarantee Company approved by the City Treasurer. The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman of the Board of Control.
City Hall, Toronto,
March 4th, 1914. 10

For Sale

One standard gauge locomotive in operating condition. Cylinders 24 in. x 18 in.

6-19 The Jenckes Machine Company, Ltd.,
Sherbrooke, Que.

Tenders Wanted

Sealed tenders will be received by the undersigned up to 4 p.m., Monday, March 16th, for the different trades required in the erection of an addition to Hamlet Ward School in the City of Stratford.

Plans and specifications can be seen at the office of the undersigned. The lowest or any tender not necessarily accepted.

10 T. J. HEPBURN, Architect,
Stratford, Ont.

Tenders Wanted

Sealed tenders addressed to the undersigned will be received up to Wednesday, March 25th, for the supply of:—

- 1—Approximately 40,000 Imperial gallons Road Oil.
- 2—Road Oil Sprinkler.

Full particulars may be had from the City Engineer.

M. FERGUSON,
City Engineer.
St. Thomas, March 7, 1914. 10-11

School Tenders

Whole or separate tenders will be received by the undersigned, up to and including Monday, March 16th, 1914, for the erection and completion of a Public School Building for the Public School Board of the City of Stratford.

The lowest or any tender not necessarily accepted.

Plans may be seen at the office of the Contractor Record.

9-10 JAS. S. RUSSELL, Architect,
Stratford, Ont.

Tenders Wanted

Tenders wanted from all trades for the erection of a four-room brick school building for school section No. 4 Humberstone. Plans and specifications may be had on and after March 12 at Mr. Chas. Ort's, Welland Junction, or at the office of the Architect, C. M. Borter, 102 Main Street, Niagara Falls, Ont. Tenders to be handed into the Secretary of the School Board, Mr. Chas. Ort, or at the office of the Architect before 6 p.m., March 27th, 1914.

The School Board reserves the right to reject any or all tenders. 10-12

Notice to Contractors Sewers

Sealed tenders will be received, addressed to the Chairman of the Board of Works, City Building, St. Catharines, Ont., up to noon on Wednesday, April 1st, 1914, for the construction of Sewers on the following streets of the Western Hill, Westchester, Henrietta, McDonald, Dexter, Victoria, Ambrose, Rebecca, Permill and Hainer.

This includes 5821 ft. 10-in., 1531 ft. 12-in., 2381 ft. 15-in., 1729 ft. 18-in., 248 ft. 20-in., 302 ft. 24-in. and 650 ft. of 30-in., all to be vitrified tile.

Plans and specifications may be seen at and forms of tender obtained from the office of the City Engineer. Envelopes containing tenders must be accompanied by a marked cheque for 5 per cent. of the amount of the tender together with the names of two personal sureties or the bond of a Guarantee Company approved by the City Treasurer. The lowest or any tender is not necessarily accepted.

10 W. P. NEAR, City Engineer.

Draughtsman Wanted

Experienced in ornamental and general light iron work. Must be capable of laying out work and taking measurements. Give experience and salary required.

10 Eberhard-Wood Mfg. Company,
36 and 38 Lombard Street,
Toronto, Ont.

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent., an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929 Contract Record, Toronto. 53-12

Notice

Applications for the position of General Foreman of Surface Work will be received until Monday, March 16th. The duties of this official will be the direction of the street maintenance department, street grading, macadamizing, sidewalk construction, curb and gutter, and retaining walls.

Applicants should state in detail their previous experience and submit testimonials, also salary required and when they can take up the duties.

Preference will be given to a man familiar with the details of street pavement construction and street railway work. Further information can be obtained from the undersigned, to whom all applications should be addressed.

A. K. GRIMMER,
City Engineer.
City Hall, Medicine Hat,
February 24th, 1914. 9-10

Bargains in Rebuilt Machinery, Located at Milwaukee, Wis.

Trench Machines

- 2 Parsons Trench Machines, cut trench from 27 in. to 60-in. wide and 20 ft. deep.
- 1 No. 0 Municipal Trench Machine, with gasoline power.
- 1 No. 1 Municipal Trench Machine, with steam engine and boiler.
- 1 No. 3 Municipal Trench Machine, with steam engine and boiler.
- 1 Buckeye Trench Machine, cuts trench 24 in. to 27 in. wide and 7½ ft. deep.
- 1 Buckeye Trench Machine, cuts trench 27 in. to 30 in. wide and 10 ft. deep.
- 1 Buckeye Trench Machine, cuts trench 24 in. and 36 in. wide and 12 ft. in depth.

Steam Shovels

- 1 45-Ton Vulcan Steam Shovel, mounted on railway wheels, 3 sets of engines.
- 1 25-Ton Vulcan Shovel, full circle, No. 1620, mounted on traction wheels.
- 1 30-Ton Little Giant Traction Shovel, 3 sets of engines, mounted on traction wheels.
- 1 No. 0 Thew Shovel full circle, mounted on traction wheels.

Miscellaneous

- 1 J. I. Case 10-Ton Road Roller.
- 2 50 Horse Power J. I. Case Hauling Engine.
- 1 25 Horse Power Reeves & Company Hauling Engine.
- 1 Lidgerwood Hoisting engine, 7 x 10, D.C.D.D., with boom swinger and boiler.
- 1 20 Horse Power Fairbanks-Morse Gasoline Engine, mounted on trucks.

Write us for prices and specifications.

10-12 Cream City Equipment Company,
400 Majestic Bldg.,
Milwaukee, Wisconsin.

“Inglis” Corliss Engines

are known above all others as being pre-eminently “Engines of Quality,” Economical, Durable and Reliable and can be depended upon to give the same good results twenty years from now.

We build them Single, Tandem, Compound and Triple, for heavy or light duty. Remember our Fifty year reputation is back of every “INGLIS” engine. Specifications and prices upon request.

The John Inglis Company

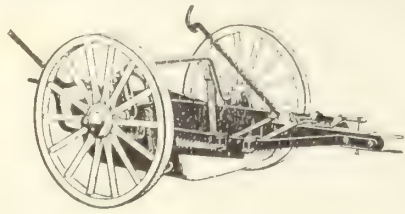
ENGINEERS AND BOILERMAKERS

Limited

14 Strachan Ave.,

Toronto, Canada

Montreal Office: Room 509 Canadian Express Building



WHEEL SCRAPERS

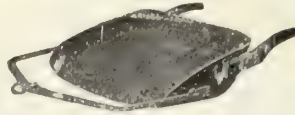
in both Pressed Bowl and Square Box styles—

No. 2 Capacity 13 cubic ft.

No. 3 Capacity 16 cubic ft.

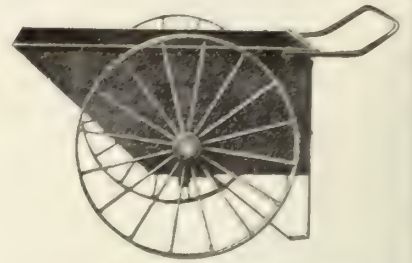
The Meaford Wheelbarrow Co. Limited

Meaford, Ontario, Canada



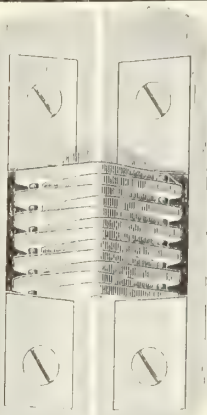
PRESSED STEEL DRAG SCRAPERS

with handles on top or sides. Four sizes—
Nos. 0-1-2-3 and 4.



STERLING CONCRETE CARTS

with self-lubricating wheels.
Five sizes—Nos. 0-1-2-3 and 4.



"A MOST INGENIOUS AND USEFUL DEVICE"

—Furnishing World

Invaluable to—

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Neat and Strong
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Vault Doors and Safes

J. & J. Taylor

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TORONTO

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No Interruptions in Lighting Service

If You Have Combination Gas and Electric Fixtures. Continuous service means a great deal to the citizens of Toronto. Home owners and builders are realizing more than ever before the value of the Combination service, with the result that more sales are being made of this class of up-to-date fixtures than ever before. Let the Gas Company's representative explain to you the advantages of this service.

The Consumers' Gas Company of Toronto

12-14 Adelaide St. West

Telephone Main 1933-1188

Be Sure and Read "GAS NEWS" Every Month.

LET US BOARD YOUR MEN

Mr. Contractor:

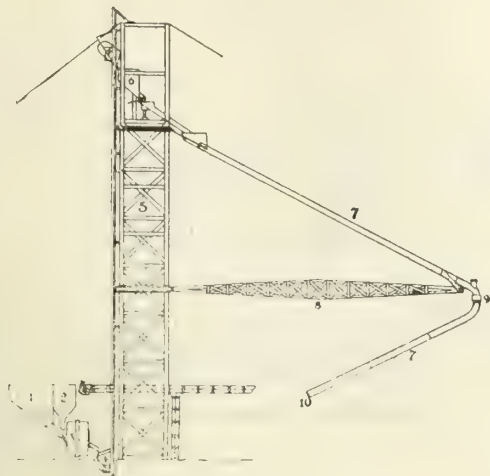
When you want a foreman you employ a man experienced in your particular line of work. Why not do the same thing in handling your boarding camps?

If you are starting a new job we will design your buildings so that the work can be handled to the best advantage; if you have already started your camp we will take it over and operate it for you, and guarantee satisfaction. We are specialists in this work. Write us for proposition.

CONSOLIDATED BOARDING & SUPPLY COMPANY

59 St. Peter Street

MONTREAL



Gravity System Distributing Concrete

A system that improves the concrete and reduces the cost.

Information gladly furnished and Estimates given on any work.

Canadian Concrete Appliance Co.

Sole Licensees for Canada Limited

613 Vancouver Block, VANCOUVER, B. C.

Eastern Representatives—

STINSON REEB BUILDERS' SUPPLY CO., LTD., MONTREAL, P.Q.



*Residence of Ralph Peters, Esq., President, Long Island R.R.
Aymar Embury II., Architect, New York.*

Shingles stained with Cabot's Shingle Stains, stucco stained with Cabot's Waterproof Cement Stains, and lined with Cabot's Quilt, for warmth.

CABOT'S CREOSOTE SHINGLE STAINS

The Standard Stains for Shingles, Siding or Trimmings. The first shingle-stain ever made, and quality guaranteed by thirty years' use. Made of the strongest and finest colors, ground in pure linseed oil, and Creosote, "the best wood preservative known." No cheapeners, no adulterations, no kerosene or benzine.

CABOT'S "QUILT"

The warmest lining. Heat-proof. Cold-proof. Sound-proof. Uninflammable, non-decaying, vermin-proof. Insulates cold-storage and ice-houses, and all other buildings. Deadens sound in floors and partitions.

Cabot's Waterproof Cement and Brick Stains

For waterproofing and tinting stucco and similar cement surfaces, and for freshening, restoring and waterproofing bricks.

Cabot's Conservo Wood Preservative

For preserving ties, poles, planking and all other lumber.

Cabot's Plasterbond Damp-proofing

For direct plastering on brick or concrete without studding or lathing. Forms a perfect permanent and impervious bond.

Cabot's Mortar Colors

Strongest, finest and most lasting.

Send for Samples and Prices.

SAMUEL CABOT, Inc., Mfg. Chemists, Boston, Mass

Canadian Agents:

A. Muirhead Co., Toronto.

Henry Darling, Vancouver.

Saskatchewan Supply Co., Saskatoon.

Braid & McCurdy, Winnipeg.

Seymour & Co., Montreal.

Can. Equipment & Supply Co.,

Calgary and Edmonton.

F. A. Gillis & Company, Halifax and Sydney.



The New Rolph & Clark Building

Equipped Throughout with

HOPE STEEL SASH

The selection of HOPE'S SASH and SKYLIGHTS for this magnificent factory building is another recognition of the superiority of our steel sash.

HOPE SASH exactly fills the requirements of the modern factory. It insures the maximum amount of light and ventilation—is absolutely fireproof, and positively keeps out wind and weather.

Write to us for our catalogue, it is interesting to architects and contractors

HENRY HOPE & SONS OF CANADA, LIMITED

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W. N. O'Neil & Co., Vancouver
Gandy & Allison, St. John, N. B.

Aikenhead Clark Hardware Co., Winnipeg
E. F. Stevens, Halifax

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"Tested Packings For Every Purpose"

This pamphlet is an authentic text-book—
a complete illustrated guide—to standard lines
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We shall be glad to send you a copy,
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Please use this coupon

Gentlemen :
Please send me a compliment-
ary copy of "Tested Packings for
Every Purpose."

Name.....

Address.....

Our Canadian Agents

Bradford, Pa.,
March 3rd, 1914

We cordially invite our friends in the Dominion to communicate with Dartnell, Ltd., Montreal, or Scott, Hammond & Pratt, Toronto, in regard to requirements for **Bradford Pressed Brick**.

As they carry a supply in stock, all usual requirements can be obtained on short notice.

These firms invite inquiries and when contractors, engineers, architects or builders find it convenient, we advise a personal call at the offices of one of these companies to discuss the merits of "**Bradford Reds**" or "**Bradford Ruffs**" in relation to the proposed construction.

Very truly yours,

Bradford Pressed Brick Co.

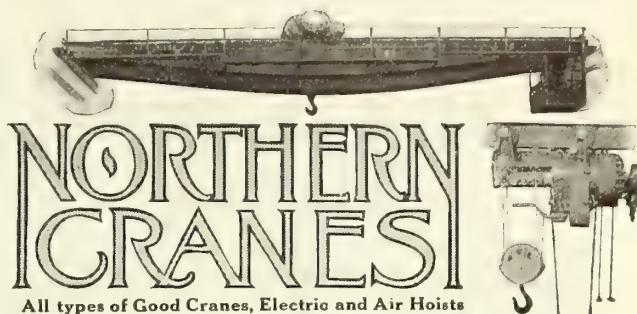
("The Red Brick People")



The Brick of the
DISTINCTIVE RED

We also make Fire-proofing, Hollow Brick and Hollow Block.

CRANES MADE IN CANADA



All types of Good Cranes, Electric and Air Hoists

NORTHERN CRANE WORKS LIMITED
WALKERVILLE, ONTARIO

For
Better
Installations
of

**Plumbing and
Heating
Systems,
Underground
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New and Relaying
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for

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Are Specified by the
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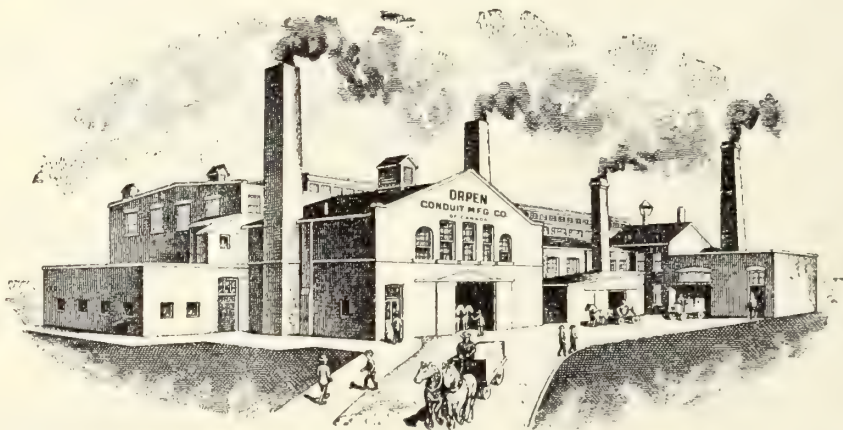
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"Xceladuct" and "Orpenite" Conduit

"Xceladuct" Galvanized Conduit—Easy-Bending Spellarized Steel Tube, doubly protected against rust by copper-plating and zinc coating—Clean threads, smooth enamelled interior, allows rapid fishing.

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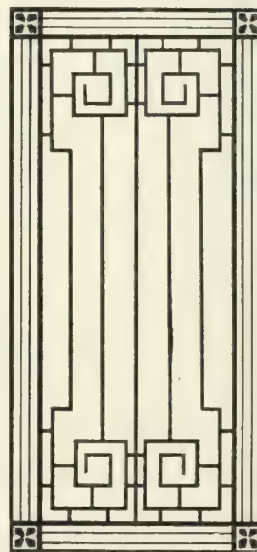
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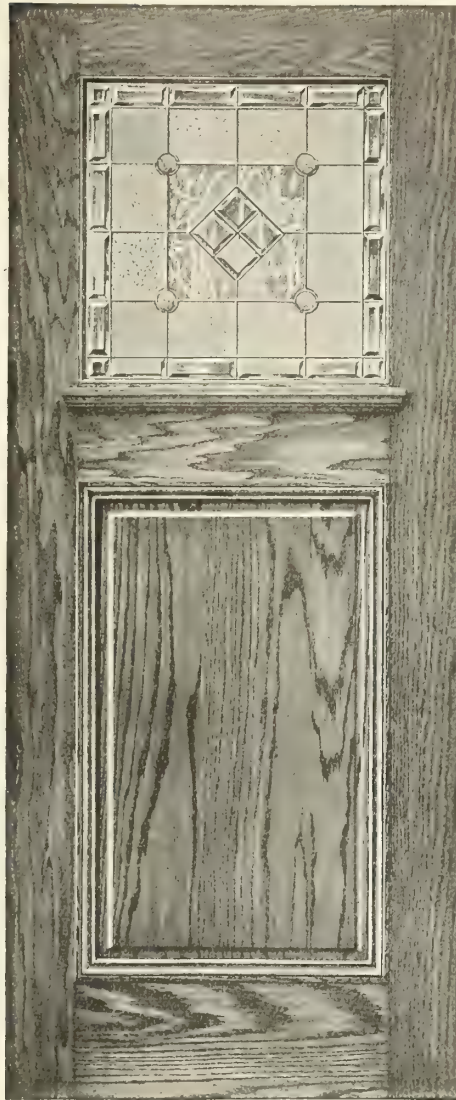
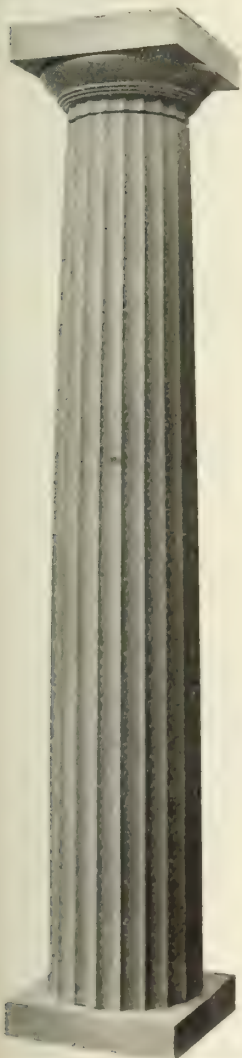
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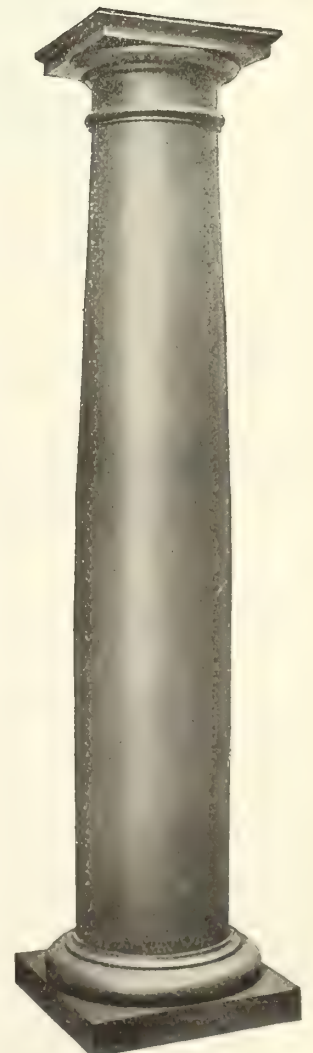
36-38 Lombard St. - TORONTO
Main 6338

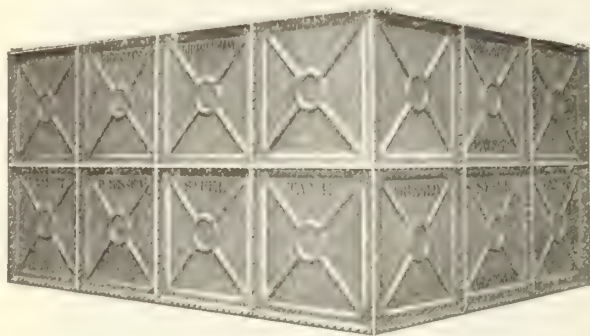
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We can supply it in blocks, sawed, planed or turned

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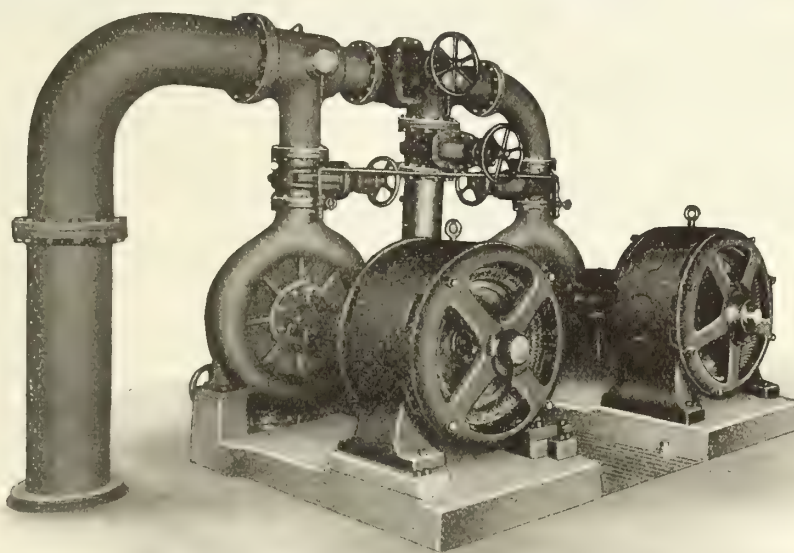
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F. C. Austin Drainage Excavator Company
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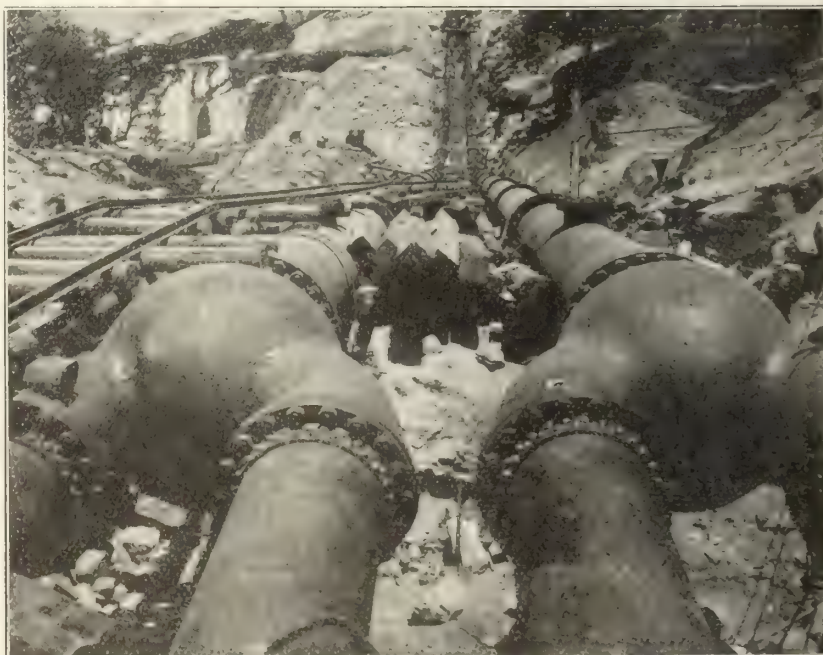
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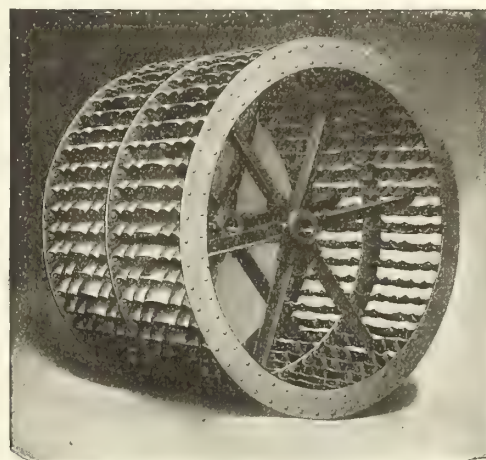
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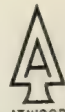
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Flexible and Flange Pipe,
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3 inches to 60 inches diameter

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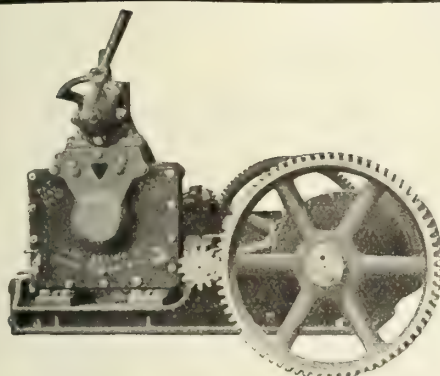
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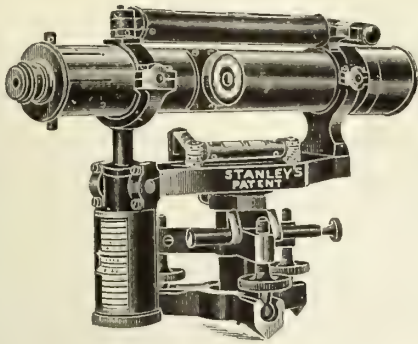
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**Towers
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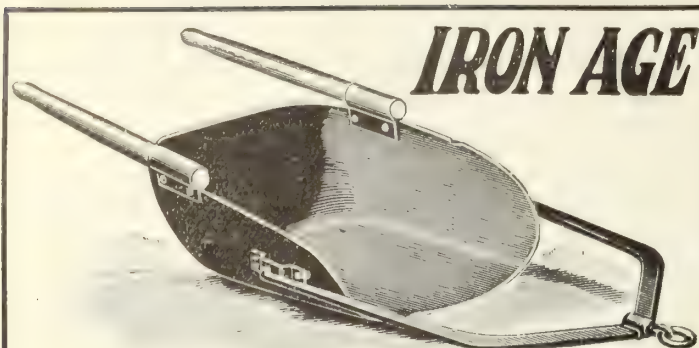
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"Iron Age" scrapers are economical to operate—always take a full load and balance and dump easily.

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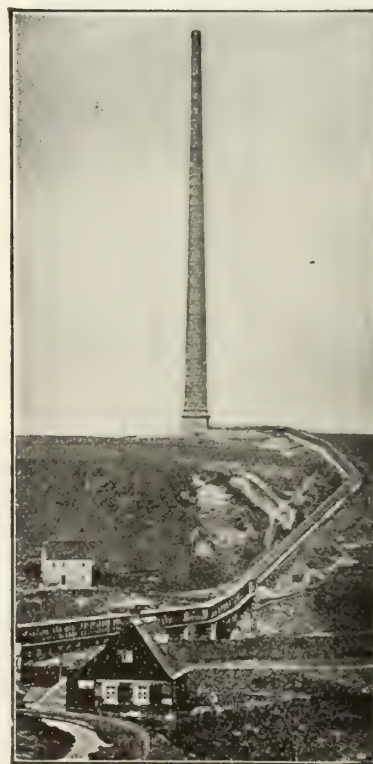
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Radial Brick chimneys are the only type that will not deteriorate from the effects of gases and erosion.

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Our prices are right and our service good.

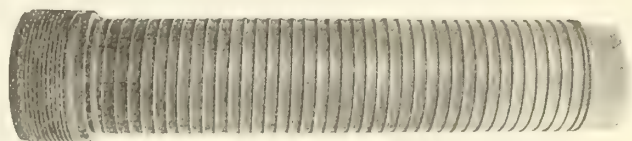
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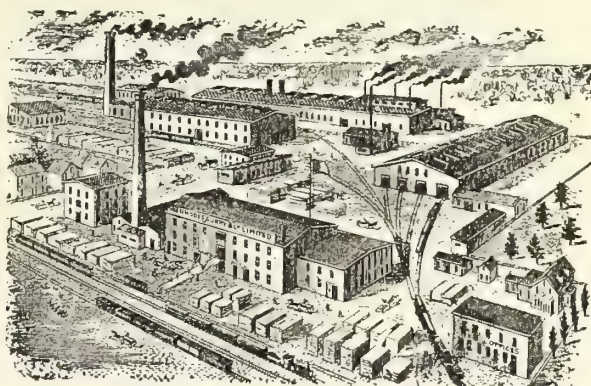
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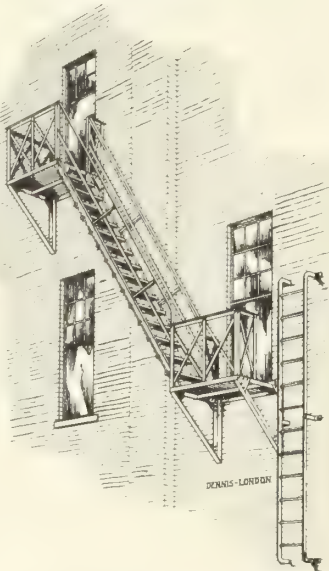
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13 MEN KILLED WHEN MINE BUCKET FALLS

Number of Other Workmen Injured—
Chain Holding 800-gallon
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(By Associated Press)

MANSFIELD, Eng., Feb. 8—Thirteen pit sinkers were killed and a number of others injured today at the Boleover colliery by the snapping of a chain to which was suspended a bucket containing 800 gallons of water.

The bucket crashed down the shaft, which was 500 feet deep and at the bottom of which the men were working. The workers were crushed into an unrecognizable mass. Only a few who happened to be in shelter holes at the sides of the shaft escaped death.

This city is the center of a large coal mining district.

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The mixers are equipped with either steam engine and boiler, power loader, gasoline engine, electric motor, belt or chain drive, or without power, as may be desired, and on either steel trucks or skids. These machines can be arranged to work as hot mixers, for melting asphalt, thawing out material and mixing bituminous macadam. Estimates furnished for any type mixer required.

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BRICKS

The following are wholesale prices delivered at Toronto:

	Per M.
No. 1 dry pressed red brick	\$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Brick	13 00
Grey Stock Brick	12 00
Wire cut brick for foundation work	11 00
Porous terra cotta brick	15 00
No. 1 enamelled brick, all colors, from	\$80 00 to \$150 00
Sand-Lime Brick (King Edward Siding)	8 10

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	\$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00

Pine—

1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
¾ x 8 and 10 in. pine shelving	36 00	42 00
¾ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8 in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22	
22x22	38 50
12x22	39 00
10x22	39 50

8x22, 14x24, 18x24, 20x24, 22x24,

24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 20 per cent. for Star and 20 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$ 6 25
26 to 40	4 60	6 75
41 to 50	5 10	7 50
51 to 60	5 35	8 50
61 to 70	5 75	9 75
71 to 80	6 25	11 00
81 to 85	7 00	12 50
86 to 90		15 00
91 to 95		17 50
96 to 100		20 50
101 to 105		24 00
106 to 110		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	\$3 25	\$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths	Single	3rds	Double
Up to 25 u.i.	\$3 50	\$5 00		
26/40	3 75	5 50		
41/50	4 25	6 25		
51/60	4 75	7 00		
61/70		8 00		
71/80		9 00		
81/85		10 00		
86/90		11 00		
91/95		13 00		
96/100		16 00		

Net prices per 100 ft. F.O.B. Winnipeg.

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SUPPLIES

Standard compression work, 65 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 70 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net \$1.85
No. 4½ Fuller's net \$2.35
Square head brass cocks, 65 and 5 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6¼ cents per lb.; traps and bends, 40 per cent.; pig lead, 6¼ cents per lb.

Size (per 100 ft.)	Black	Galvanized
¾ inch	\$2.16	¾ inch \$3.06
1 inch	2.16	1 inch 3.06
1½ inch	2.64	1½ inch 3.57
2 inch	3.05	2 inch 4.20
2½ inch	4.51	2½ inch 6.21
3 inch	6.10	3 inch 8.40
3½ inch	7.29	3½ inch 10.04
4 inch	9.81	4 inch 13.51
4½ inch	16.80	4½ inch 21.65
5 inch	20.66	5 inch 28.31

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 and 10 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in. 25c ft.	15-in. 1.40 ft.
6-in. 40c ft.	18-in. 1.90 ft.
9-in. 70c ft.	20-in. 2.25 ft.
12-in. 1.00 ft.	24-in. 3.25 ft.

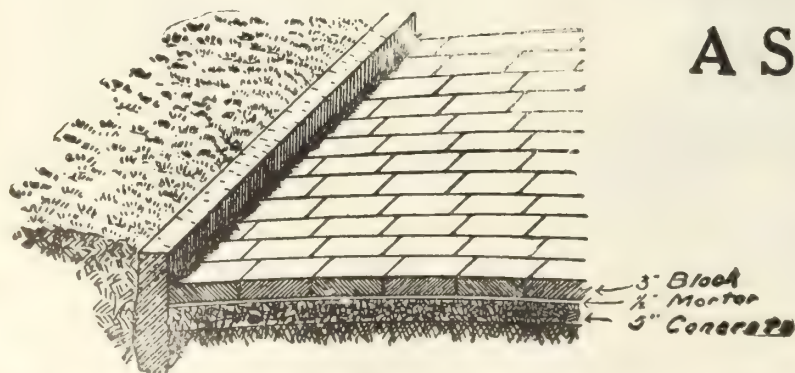
all less 60 per cent.

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Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.
Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.
Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; ¾-inch, \$1.45.
Burnt River rubble stone delivered, \$16 to \$17 per toise.
Plain steel bars, \$2.25.
Square twisted bars, ¾ to 1¼, \$2.35.
Malleable fittings — Canadian discount, 45 and 42½ per cent.
Free stone delivered, \$15 to \$18 per toise.
Brown coursing stone, delivered, \$3.75 per yard.
Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.
Sand, for cement or brick work, \$1.20 a cubic yard, f.o.b. Toronto, C. P. R. siding.
Sand, for cement or brick work, 85c to \$1.00 a cubic yard, f.o.b. Toronto, G. T. R. sidings.
Brown sills and heads, in the rough, delivered, 40 cents per foot.
Rubble stone in car lots, \$1.30 per ton.
Steel channels and beams, angles and plates, \$2.55 to \$2.90 per 100 pounds, delivered f.o.b. Toronto.
Hard Wall Plaster, unsanded from \$8.00 to \$8.50, bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.
Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.
Plaster of Paris, Anchor and Crown Brands, \$1.50 bbl.
Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, \$8.75 per 100 lbs.
Boiled Linseed Oil in bbls., 65c per gal. of 9 lbs.
Raw Linseed Oil, in bbls., 62c per gallon.
Pure Red Lead, dry, \$7.00 to \$8.00 per 100 lbs.
Putty, pure linseed oil, in bulk, bbls., 3¼c.
Putty, pure linseed oil, in 25-lb. tins, 4c.
Turpentine in bbls., 66c.



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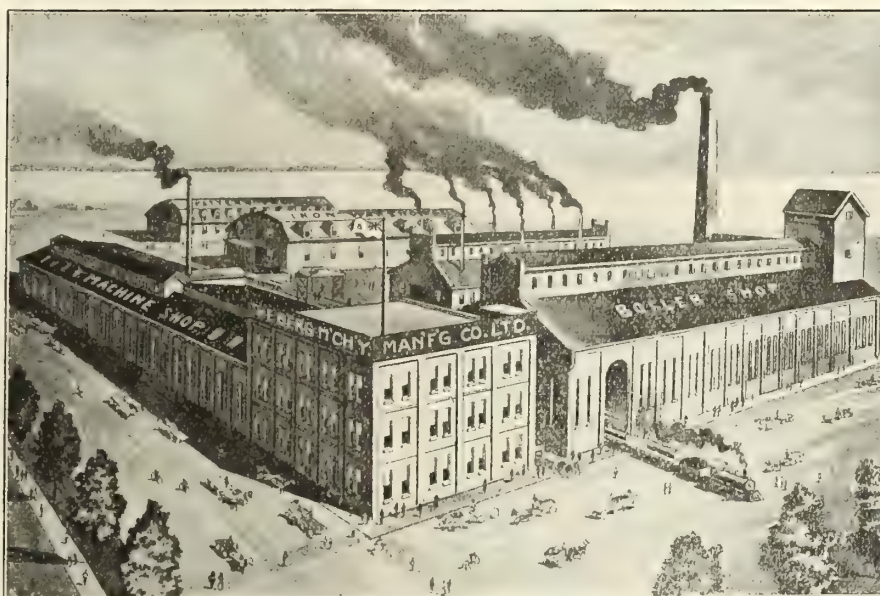
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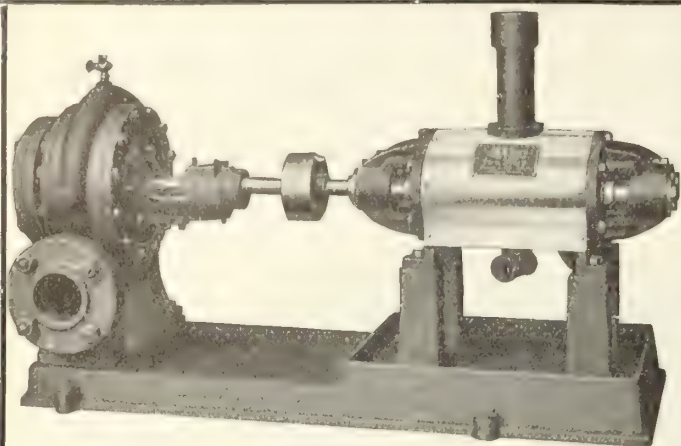
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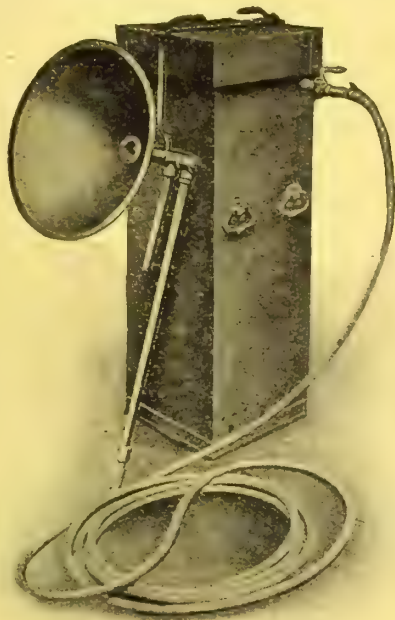
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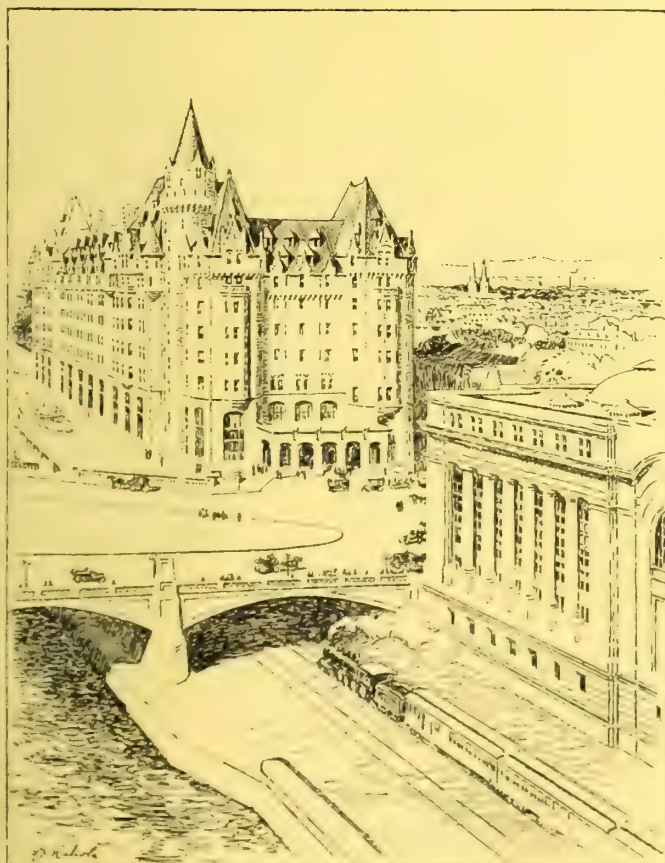


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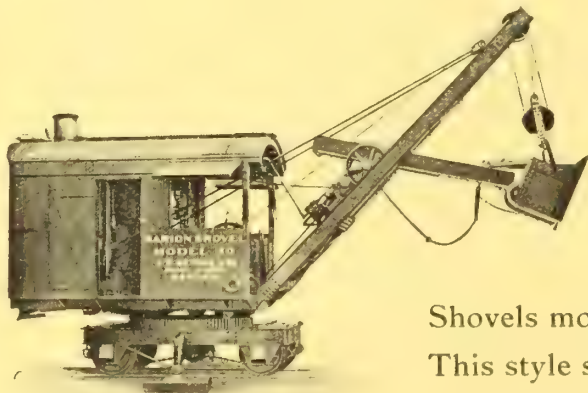
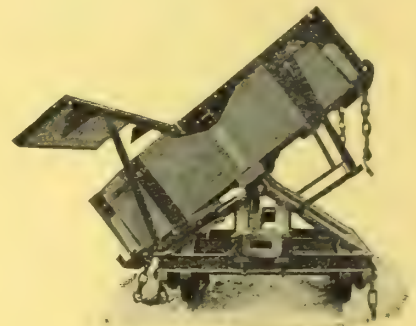
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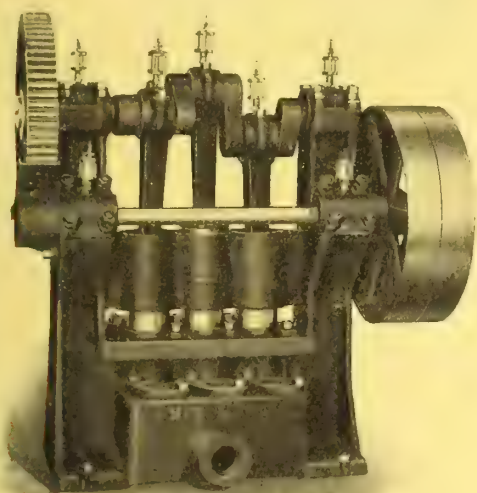
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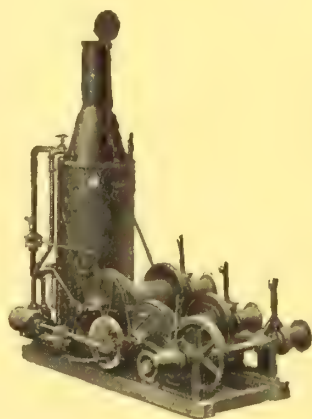
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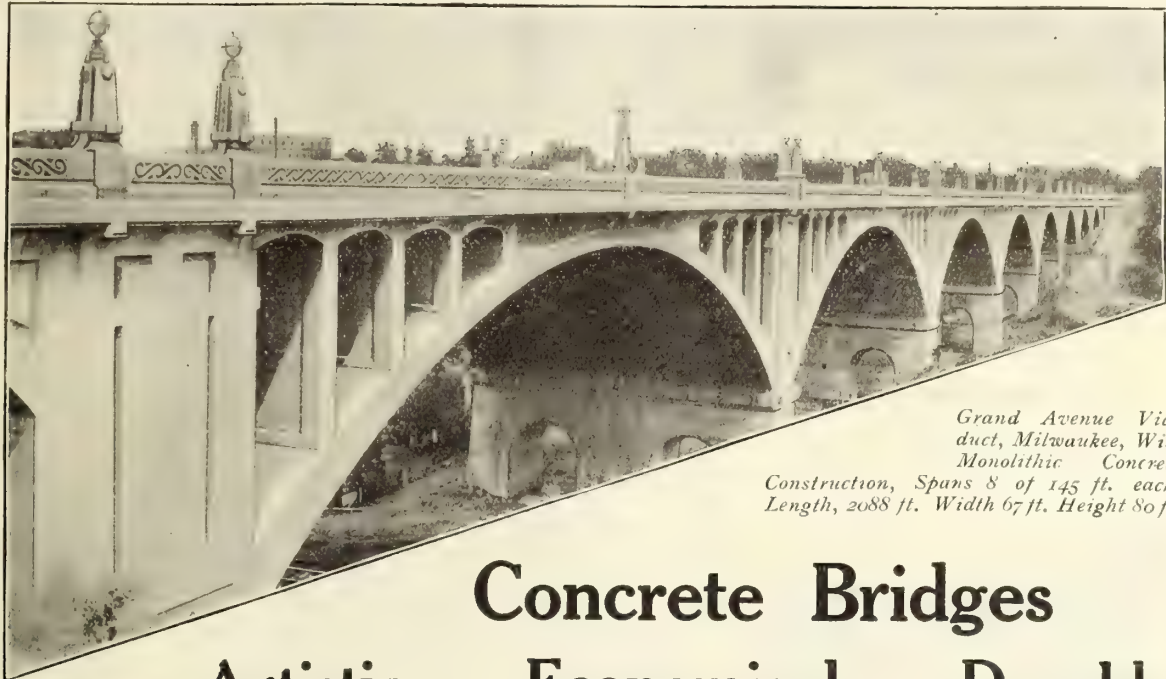
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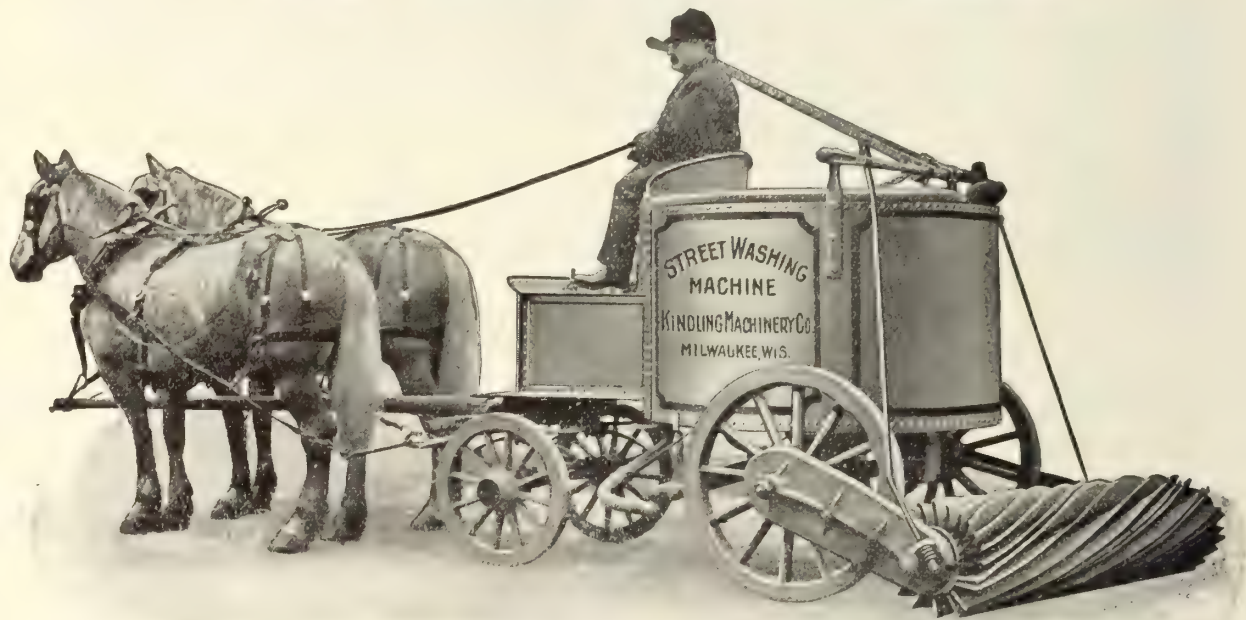
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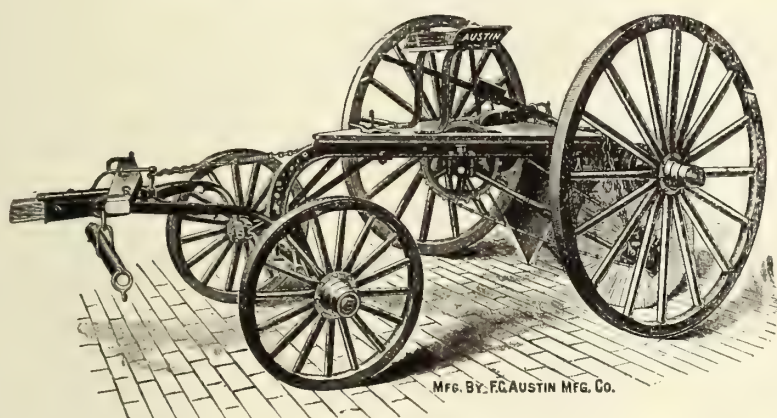
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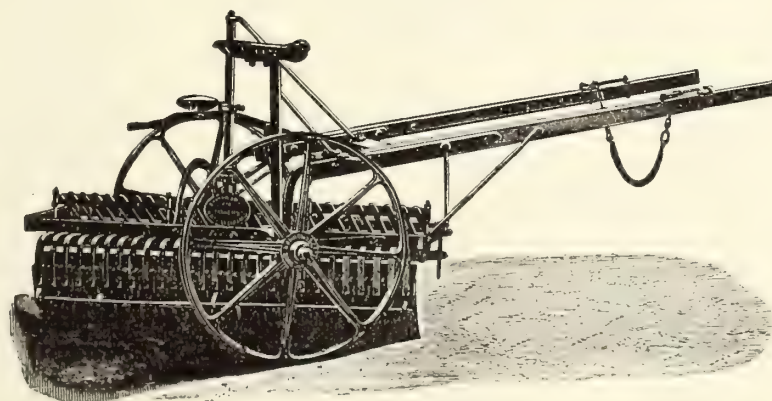
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Our Specialty is the Design, Manufacture and Erection of ELEVATED STEEL TANKS for Municipal, Railroad and Factory Service.

We also design, manufacture and construct Oil Tanks, Coaling Stations, Bridges, Turntables, Building and Structural Material.

WRITE TO-DAY FOR CANADIAN ILLUSTRATED CATALOGUE NO. 15

OFFICES: Bridgeburg, Ont., 130 Janet St.
Chicago, Ill., 1360 W. 105th St.

SHOPS: Bridgeburg, Ont.
Chicago, Ill.
Greenville, Pa.

CONTRACTORS' EQUIPMENT

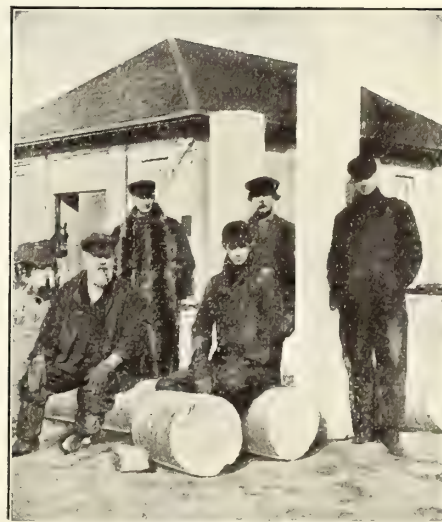
PILE HAMMERS

An 800-pound piston that strikes 4 powerful blows every second, is the effective energy behind our 5000-pound Sheet Piling Hammer.

The remarkable power of this hammer could not be attained without our new Accelerating Piston. This simple and basic improvement is broadly covered by patents and can only be had with McKiernan-Terry Pile Hammers.

CORE DRILLS

The 16 in. hard limestone cores shown here were taken out by one of our Type "C" McKiernan-Terry core drills operated by the Corporation of Winnipeg. We can furnish machines for taking out cores up to 30 in. in diameter. We carry a full line of spare parts and drilling tools at all our District Offices.

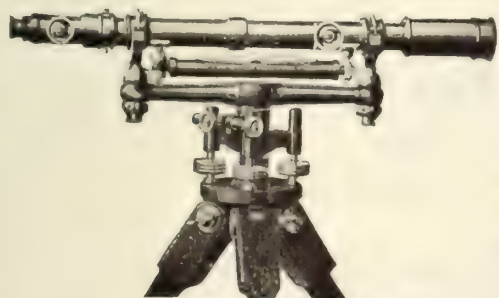


CANADIAN ALLIS-CHALMERS, LIMITED

Manufacturers of: Air Compressors, Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Locomotives, Logging Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Turbines, Structural Steel Transmission Machinery, Turbine Pumps, Water Pipe, Water Wheels.

HEAD OFFICES: TORONTO. District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Vancouver, Victoria, Prince Rupert

GURLEY LEVELS



Standard
Since
1845

Accurate.
Dependable.
Hold their
Adjustment.

Four sizes, 15 inch to 22 inch.

W. & L. E. GURLEY, Troy, N. Y.
Branch Factory, Seattle, Wash.

AN OPPORTUNITY

Local Agents Wanted in

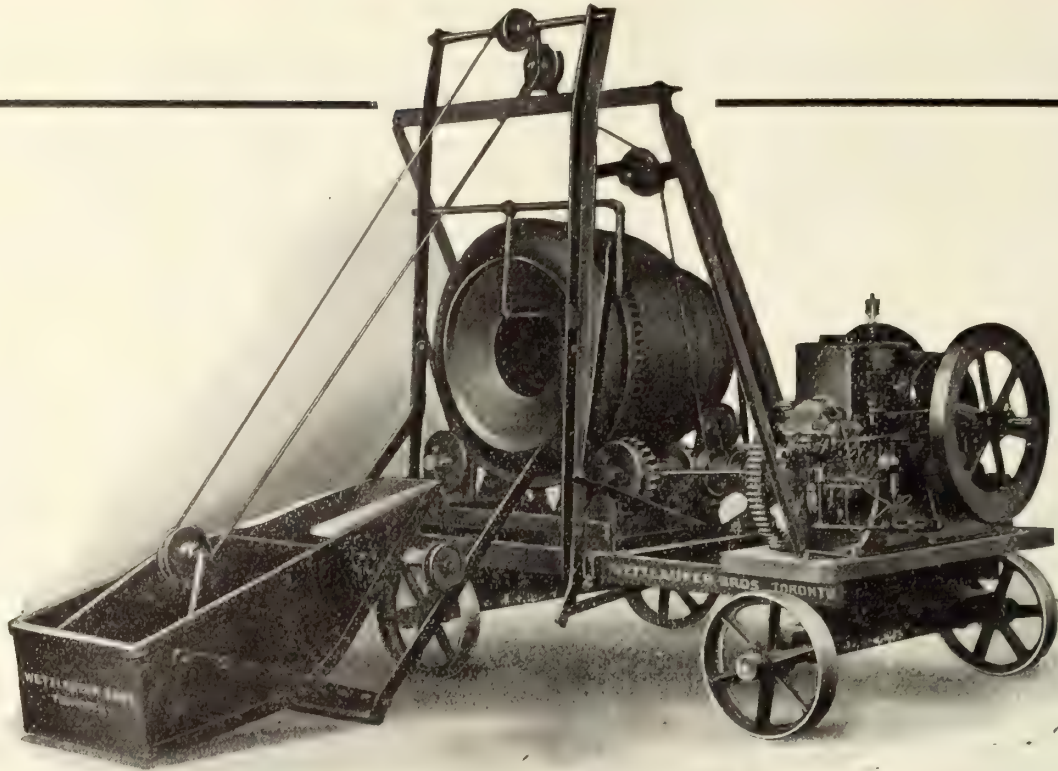
Quebec, Ottawa, Toronto, Winnipeg, Calgary,
Edmonton, Vancouver

Water Filters Refrigerating Machinery
1,000 to 1,000,000 Gallons a Day 1/4 to 60 Ton Daily Capacity
Water Purifiers
4 Gallons to 5,000 Gallons a Day

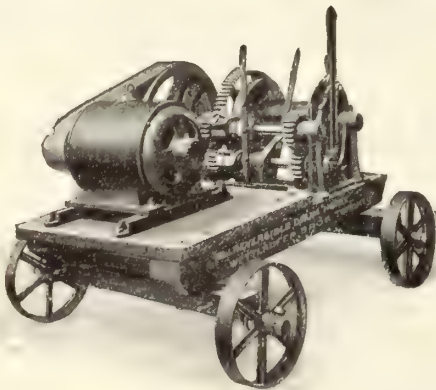
Refrigerators and Refrigerating Boxes for Ice or
Machine Refrigeration
Hotel, Restaurant and Saloon Equipment and Supplies

EQUIPMENT & SUPPLIES, LIMITED

302 MCGILL BLDG., MONTREAL, P. Q.



Mixers and Hoists

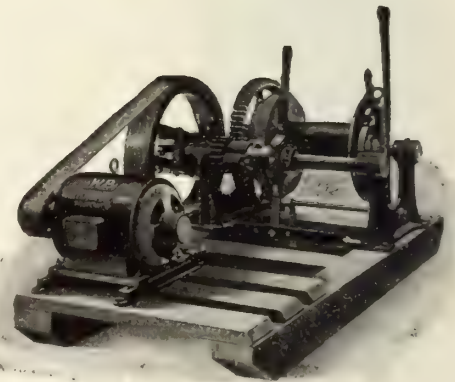


When it is time to buy new equipment be sure and examine the Wettlaufer line or Heart Shape Drum Mixers and Hoists.

Wettlaufer Mixers are famous the country over for their thorough mixing.

Wettlaufer Hoists are made in fourteen different types and sizes.

Attend a daily demonstration at any branch.



Wettlaufer Bros.

178 Spadina Ave., Toronto, Ont.

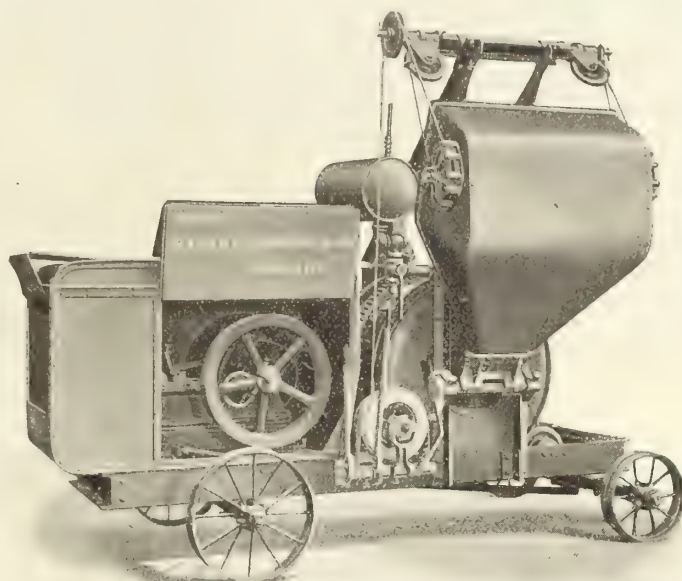
Factories: Mitchell, Ont. - Buffalo, N.Y. - Detroit, Mich.

AGENCIES:

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ANNOUNCEMENT

=====
**Most
 Mixing**
 =====



=====
**Least
 Fixing**
 =====

It is with much satisfaction that we announce to the contractors and builders of Canada our recent connection with the Marsh-Capron Mfg. Co., of Chicago. Knowing full well the heavy demands placed upon a concrete mixer in Canada we spared no effort to determine which, in our estimation, was the best mixer built. As a result of this investigation we are proud to offer

THE M-C RAIL TRACK MIXER

Equipped with Fairbanks-Morse Gasoline Engines

There are several hundred of these mixers in successful operation in Canada—there were five used on the big C. P. R. irrigation job at Bassano, Alberta. We carry a complete stock of all sizes and equipment at our several warehouses and are always in a position to make immediate shipments quick.

Write our nearest branch

CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Victoria Vancouver

Manufactured by

Marsh-Capron Mfg. Company
 465 Old Colony Bldg., CHICAGO

CONTRACTORS' LOCOMOTIVES



High grade workmanship and design, special attention being paid to economy of fuel and maintenance. Fifty years experience as builders. Duplicate parts carried in stock for immediate shipment. Engine built to meet government regulations of the various Provinces.

We are also builders of stationary boilers, suitable for contractors and industrial plants.

CONSULT US BEFORE PURCHASING A LOCOMOTIVE

CANADIAN LOCOMOTIVE COMPANY LIMITED, KINGSTON, ONTARIO, CANADA

VITREOUS FACE BRICK



OUR BRICK SHOWROOM IN MAIL BUILDING

Keep the following Names
in Mind when Ordering
High Grade Brick.

Beaver Clay Mfg. Co.

**Columbus Brick and
Terra Cotta Co.**

**Hydraulic-Press Brick
Co.**

**Hocking Valley Fire
Clay Co.**

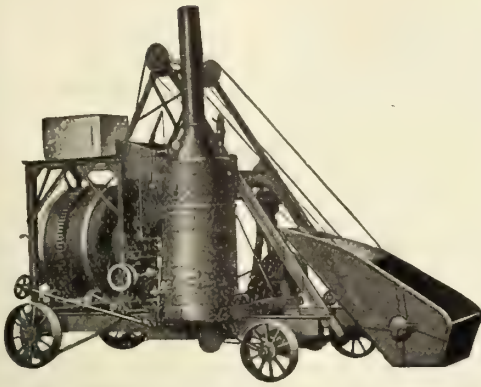
Kushequa Brick Co.

**Ohio Mining & Mfg.
Co.**

**Pearl Clay Products
Co.**

**Tiffany Enameled
Brick Co.**

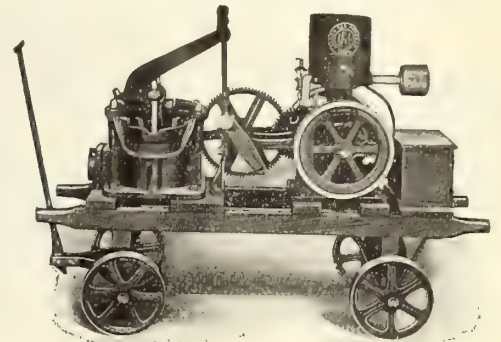
BLACK BUILDING SUPPLY CO., LTD. - TORONTO



Rear Discharge Paving Machine with Forward Loader.

We are the largest manufacturers of Concrete Machinery in Canada.

We Cannot Afford to Make anything but the Best.



Diaphragm Pump with Power



Standard Hoisting Engine

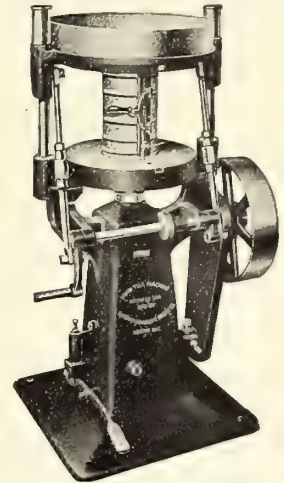
CONCRETE MIXERS, MORTAR MIXERS, CONCRETE BLOCK MACHINES, CEMENT BRICK MACHINES, CEMENT TILE MACHINES, TILE MOULDS, ROCK CRUSHERS, PUMPING OUTFITS, HOISTS & DERRICKS

London Concrete Machinery Co. Limited

Head Office and Factory :
Cabell St. and Kitchener Ave., LONDON, ONT.

BRANCHES:
WINNIPEG—445 Main Street—W. H. Rosevear, Manager.
CALGARY—622 9th Ave. West—P. D. McLaren, Manager.
TORONTO—112 York Street—F. D. Kinsley, Manager.
HALIFAX—68 Upper Water Street—R. R. Power, Manager.

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Montreal, P. Q.—Foss & Hill Machinery Co.
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Quebec, Que.—A. D. Masson.
Ottawa—The General Supply Co., of Canada.



Dunn Cement Drain Tile Machine

Sherardized Herringbone Lath



Best Metal Protection

is protected by the very latest and best development in the art of galvanizing. Professor Burgess, Metallurgist of the University of Wisconsin, reports that it took him 304 minutes to dissolve in dilute acid, a given amount of filings from the sherardizing coating. It took only 20 minutes to dissolve the same quantity of filings from hot galvanizing.

When you specify a galvanized metal lath, you do so because you want the very best. Then why not specify the best galvanized lath—SHERARDIZED HERRINGBONE?

Clarence W. Noble,

Winnipeg

General Sales Agent

117 Home Life Building, TORONTO

Montreal

The Metal Shingle & Siding Company, Manufacturers

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- | | | | |
|--|---|---|--|
| Field Instruments
Gurley, W. & L. E.
Filters
American Water Softener Co.
Fire Brick
Ontario Lime Co., Ltd.
Smyth & Ryan
Fire Escapes
Manitoba Bridge & Iron Works.
McGregor & McIntyre
Fireproof Doors and Windows
Feather & Roadhouse
Hope & Sons, Henry.
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Pedlar People Limited.
Steel & Radiation Limited
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Lecky & Collis
Fixtures (Gas)
Consumers Gas Co.
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Springer, O. T.
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Canadian Buffalo Forge Co.
Sheldons Limited
Canadian Sirocco Co.
Forgings
Canadian Billings & Spencer, Ltd.
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Gasoline Engines
Armstrong Mfg. Co.
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Consolidated Glass Co.
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Luxfer Prism Co.
Toronto Plate Glass Imp't'g Co.
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Dull Co., Raymond W.
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Escher Wyss & Co.
Mannesmann Tube Company.
Pittsburgh Valve, Foundry & Construction Company
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Northern Crane Works.
Roelofson Elevator Works
Hoisting Apparatus
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Beatty & Sons, M.
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Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
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Hopkins & Co., F. H.
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Sturtevant Co. of Can. Ltd., B. F. | Heating Apparatus
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Canadian Sirocco Co.
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Jamieson Lime Co.
Ontario Lime Co., Ltd. | Lighting and Pumping Installations
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Canadian Locomotive Company
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F. H. Hopkins Co.
Mussens Limited
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Stark Rolling Mill Co.
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Metallic Roofing Co.
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Pedlar People Limited.
Steel & Radiation Ltd
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Ferranti Electrical Mfg. Co.
Canadian Allis-Chalmers, Ltd.
Meters, Water
Hopkins & Co., F. H.
McDougall Caledonian Iron Wks
Neptune Meter Co.
Overhead Runways
Brown Hoisting Machinery Co.
Morris Crane & Hoist Co., Herbert.
Paints and Varnishes
Dominion Paint Works
Hopkins & Co., F. H.
Paints (Bridge and Structural Iron and Pipe Coating)
Dominion Paint Works
(Continued on Page 14) |
|--|---|---|--|

Ferranti Meters



THE smallest amount of current on the heaviest load is accurately measured on a Ferranti meter. Our meters are guaranteed for three years against all mechanical or electrical defects.

Ferranti meters are assembled and thoroughly tested at our Toronto or Winnipeg warehouses where a large stock is always on hand.

Illustration shows our improved type "C" meter, single or polyphase; top or bottom connections; clock or cyclometer dials.

A postal card will bring complete particulars on Ferranti meters.

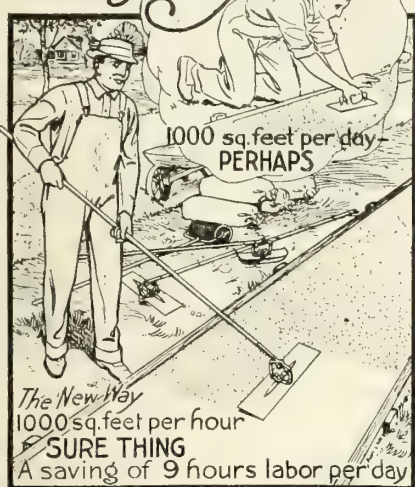
The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG

If you are not using
"ABRAM"
TOOLS

It is plain to be seen
 you are
 losing money



Abram Cement Tool Co.,
 Windsor, Ontario



WESTERN DUMP CARS

played a big part in the consummation of the greatest engineering feat of modern times—the construction of the

Panama Canal

In this enterprise they made a world-renowned record for economical handling of material in the excavation of the canal.

Their value over any other make of equipment was thoroughly recognized by the men in charge of the great undertaking.

WRITE FOR CATALOGUE.

Western Wheeled Scraper Co.

AURORA, ILLINOIS

Earth and Stone Handling Machinery
 Dominion Equipment & Supply Co., Winnipeg-Calgary-
 Edmonton—Agents for Manitoba, Saskatchewan & Alberta
 Canadian Equipment Co., Montreal
 Agents for Eastern Canada

Macadam Roads



*must be built
 of a*

Tough Stone

*that
 will cement*

WE HAVE IT

The Hagersville Contracting Company, Limited
 Hagersville - Ont.

CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

- Partition Hangers
Springer, O. T.
- Paving and Paving Materials
Asphalt & Supply Co.
Aztec Oil Asphalt Co.
Baker Co., R. D.
Barber Asphalt Paving Co.
Dominion Creosoting Company
Ontario Asphalt Block Co.
Paterson Mfg. Co., B.
- Perforated Metals
Canada Wire & Iron Goods Co.
Greening Wire Co., B.
- Pipe (Concrete, Iron and Wood)
American Spiral Pipe Works
Canadian Allis-Chalmers, Ltd.
Canadian Pipe Co.
Dominion Concrete Co.
Gartshore-Thomson Pipe Co.
Mannesmann Tube Company.
National Concrete Mfg. Co.
National Iron Works
National Pipe & Foundry Co.
Pacific Coast Pipe Co.
Piggott & Co., Thos.
United States Cast Iron Pipe Co.
Vancouver Wood Pipe & Tank Company.
Walsh Plate & Structural Works.
- Pile Driving Machinery
American Hoist & Derrick Co.
Browning Company
Brown Hoisting Machinery Co.
Canadian Ingersoll-Rand Co.
Lecky & Collis
- Pipe Fittings and Flanges
Pittsburgh Valve, Foundry & Construction Company
- Plumbing Supplies
Mueller Mfg. Co., H.
- Planing Mill Exhausters
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Sheldons Limited
Canadian Sirocco Co.
- Plaster
Alabastine Hardmortar Co.
Albert Mfg. Company
Britnell & Company
Ontario Lime Co., Ltd.
- Plumbing
Dietrich Limited
- Pneumatic Machinery
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- Portable Saws
Canadian Fairbanks-Morse Co.
- Portable Track
Bechtels Limited
- Pumps and Pumping Machinery
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Boving Company of Canada
British Mfrs. Assn. of Canada.
Canadian Allis-Chalmers, Ltd.
Canadian Buffalo Forge Co.
Canadian Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co.
Canadian Sirocco Co.
Cook, A. D.
Gray Mfg. & Machine Co.
Hamilton Mfg. Co., Wm.
Honig & Mock.
Inglis & Company, John
McDougall Caledonian Iron Wks.
Morris Machine Works.
Smart-Turner Machine Co.
Waterous Engine Works Co.
Mussens Limited
Ontario Wind Eng. & Pump Co.
Wettlaufer Bros.
- Plug Drillers
Canadian Ingersoll-Rand Co.
- Power Engines
Inglis Company, John
Jenckes Machine Company
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Waterous Engine Works
- Quarry Machinery
Canadian Allis-Chalmers, Ltd.
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George Anderson & Co.
Goodwin, Barsby & Company.
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- Radial Brick Chimneys
H. R. Heinicke Inc
- Railway Supplies
Gartshore, John J.
Hopkins & Co., F. H.
Lecky & Collis
Mussens Limited
- Refrigeration Machinery
Equipment & Supplies, Limited.
Linde British Refrigeration Co.
- Reinforcements, Concrete & Steel
Brown Hoisting Machinery Co.
Canada Steel Co., Ltd.
Canada Wire & Iron Goods Co.
Dominion Iron & Steel Co.
Greening Wire Co., B.
Pedlar People Limited.
Steel & Radiation Ltd.
Trussed Concrete Steel Co.
Turner, C. A. P.
- Road Asphalt
Barber Asphalt Paving Co.
Asphalt & Supply Co.
- Road Machinery
Dore & Fils
General Car & Mach. Works
Lecky & Collis
Morrison & Co., T. A.
Mussens Limited
Waterous Engine Works Co.
Western Wheeled Scraper Co.
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Goodwin, Barsby & Company.
Greening Wire Co., B.
- Roof Glazing
Hope & Sons, Henry.
- Roofing Material
Asbestos Mfg. Company
Barber Asphalt Paving Co.
Bird & Son
Can. H. W. Johns-Manville Co.
Can. Supply & Contracting Co.
Metallic Roofing Company
Noble, Clarence W.
Paterson Mfg. Co.
Pedlar People Limited.
- Rubber Belting
Canadian Fairbanks-Morse Co.
- Safes and Vaults
Taylor, J. & J.
- Sand and Gravel
Ontario Lime Co., Ltd.
Sand and Supplies Limited
York Sand and Gravel Co.
- Screens
Canada Wire & Iron Goods Co.
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- Sewerage Ejectors
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- Sewer Pipe
Britnell & Company
Canada Iron Corporation
Dominion Sewer Pipe Co.
Gartshore Thomson Pipe Co.
National Iron Works
Nova Scotia Clay Works Ltd.
Ontario Lime Co., Ltd.
Ontario Sewer Pipe Co.
Smyth & Ryan
Standard Clay Products Ltd.
- Sewer Trenching
Lecky & Collis
- Sound Deadening
Cabot, Inc., Samuel
- Stains, Shingle, Cement & Brick
Cabot, Inc., Samuel
- Stair Builders
McGregor & McIntyre
(Continued on page 16)

What Big Contractors

Say About This Koppel Car

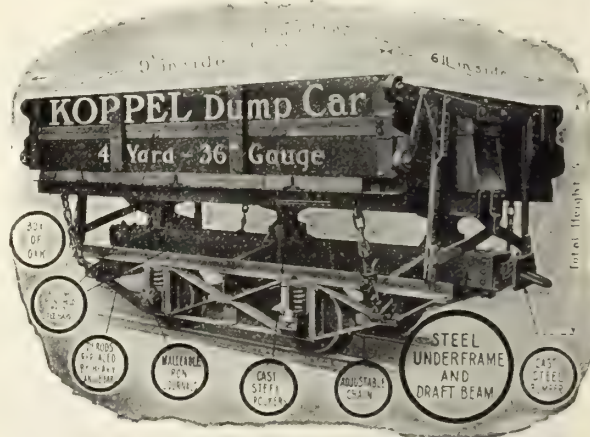
Just to show you what contractors think of Koppel Cars, we quote below a letter from McMenamin & Sims, Contractors, of Philadelphia, Pa., referring to the type of car shown here:—

"The car was used here for hauling clay, gravel, and loose earth only. We find it is an excellent car, very much better than the average two way dump car. The car dumps very easily when loaded and returns to the upright position with ease. When dumped the material runs out freely and the bed in dumped position clears the dumped material very nicely.

In dumping any car we find that the initial lift requires the most men. This is greatly alleviated by the manner in which you have your bed supported on the truck. Our shovel engineers say it is a very easy car to load, as the bed is low, broad and long, thus obviating the necessity of getting the dipper so exactly above the center of the car."

This car is built for 36-inch gauge and will carry a heaping load of over 6 yards. It is designed for hand or air dump, and on account of the long side throw the material is dumped clear of the rails. Large quantities of these cars are kept in stock at Koppel, Pa.

Let us send you catalogue and specifications.



Orenstein-Arthur Koppel Co.

CANADIAN SALES AGENTS

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria



Capacity 4000 Tons Daily

Crushed Stone

For all purposes
Any size
Any quantity
We ship promptly
Let us quote you
prices on your
requirements.

Canada Crushed Stone Corporation, Limited

Dundas

Ontario

NOTE THE PERPENDICULAR POSITION OF THE Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto

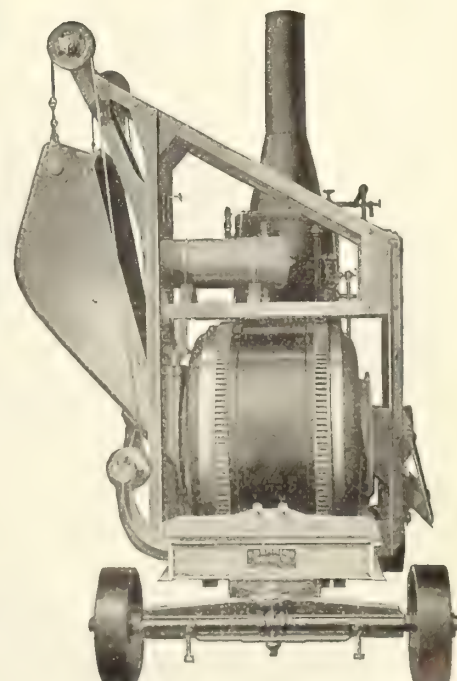
Winnipeg

Calgary

Vancouver

Montreal

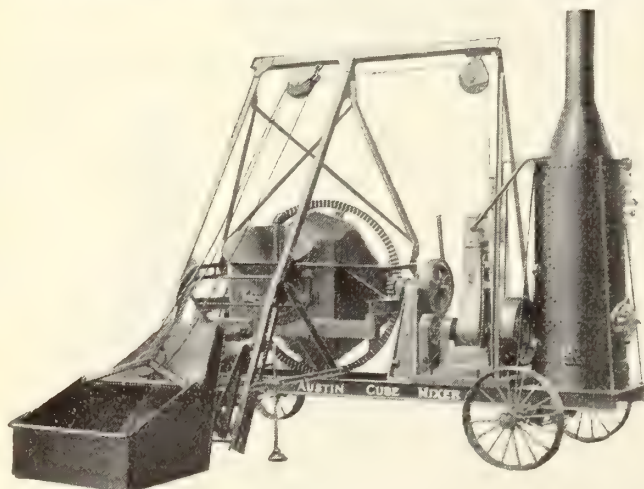
Ottawa



CLASSIFIED INDEX TO ADVERTISEMENTS—Continued

- Shovels (Steam)**
Browning Co.
Beatty & Sons, M.
Canadian Allis-Chalmers, Ltd.
Montreal Locomotive Works
Mussens Limited
Rock & Power Machinery, Ltd.
Thew Automatic Shovel Co.
- Skylights**
Hope & Sons, Henry
- Smoke Stacks**
Chicago Bridge & Iron Works
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Manitoba Bridge & Iron Works.
Pittsburgh-DesMoines Steel Co.
Walsh Plate & Structural Works
- Steam Apparatus and Specialties**
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Pittsburgh Valve, Foundry and Construction Company
Sheldons Limited
Sturtevant Co. of Can. Ltd. B. F.
- Steel Doors**
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- Steel Trucks**
Gray Mfg. & Machine Co.
- Steel Tubes**
Mannesmann Tube Co.
- Steam Turbines**
British Mfrs. Assn. of Canada.
Canadian Allis-Chalmers, Ltd.
McDougall Caledonian Iron Wks.
- Steel**
Canada Steel Co., Ltd.
Can. Billings & Spencer
Lecky & Collis
- Steel Bars**
Canada Steel Co., Ltd.
Dominion Iron & Steel Co.
Steel & Radiation, Ltd.
- Steel Pipe**
Gerald Lomer, Limited
Mannesmann Tube Company.
- Steel Sash**
Hope & Sons, Henry.
- Steel Sheet Piling**
Drury Company, H. A.
- Stone**
Britnell & Company
Brodie, James
Consolidated Stone Company
Contractors' Supply Company
Crushed Stone, Limited
Hagersville Contracting Co.
Morrison & Co., T. A.
Myers, Oakley
Ontario Lime Co., Ltd.
Queenstown Quarry Co.
Rogers Supply Company
Sackville Freestone Company
Sand & Supplies
Smyth & Ryan
- Stone Saws**
Anderson, Geo.
- Structural Iron and Steel**
Canadian Allis-Chalmers, Ltd.
Canada Steel Company
Chicago Bridge & Iron Works
Dominion Bridge Company
Drury Company, H. A.
Mackinnon Holmes & Co.
Manitoba Bridge & Iron Works
Maritime Bridge Company
McGregor & McIntyre
Phoenix Bridge & Iron Works
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Reid & Brown
Sarnia Bridge Company
Structural Steel Company
Standard Steel Construction Co.
Toronto Structural Steel Co.
Walsh Plate & Structural Works
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Lecky & Collis
- Swinging Gears**
Dake Engine Company
- Tanks and Stand Pipes**
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Hamilton Mfg. Co., Wm.
Ingilis, John
Jenckes Machine Co.
Manitoba Bridge & Iron Works.
Marsh & Henthorn
McDougall Caledonian Iron Wks.
Ontario Wind Eng. & Pump Co.
Piggott & Co., Thos.
Pittsburgh-DesMoines Steel Co.
Vancouver Wood Pipe & Tank Company.
Walsh Plate and Structural Wks.
Waterous Engine Works Co.
- Terra Cotta**
Northwestern Terra Cotta Co.
- Testing and Inspecting Bureau**
Hunt & Co., Robt. W.
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Morris Crane & Hoist Co., Herbert.
- Traction and Lighting Poles**
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Tuec Company
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Pittsburgh Valve, Foundry & Construction Company
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Canadian Sirocco Company
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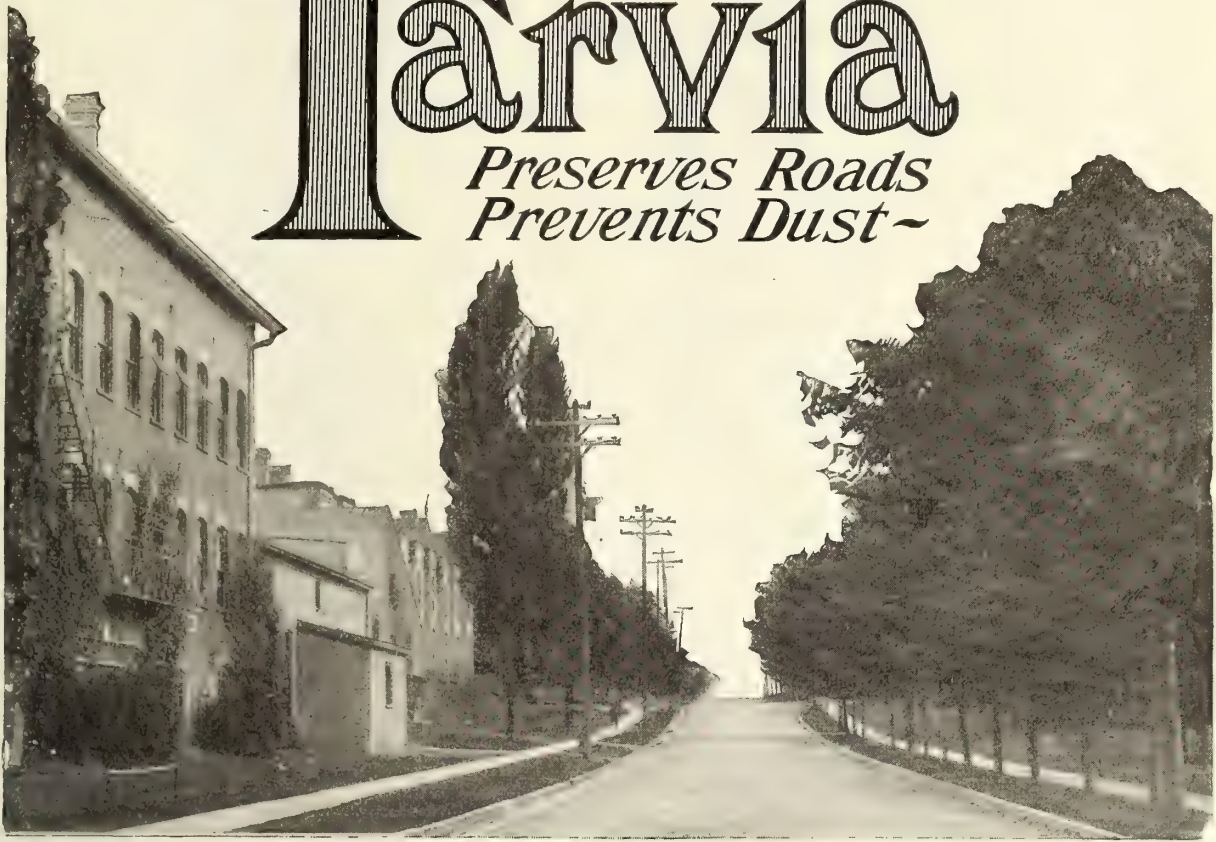
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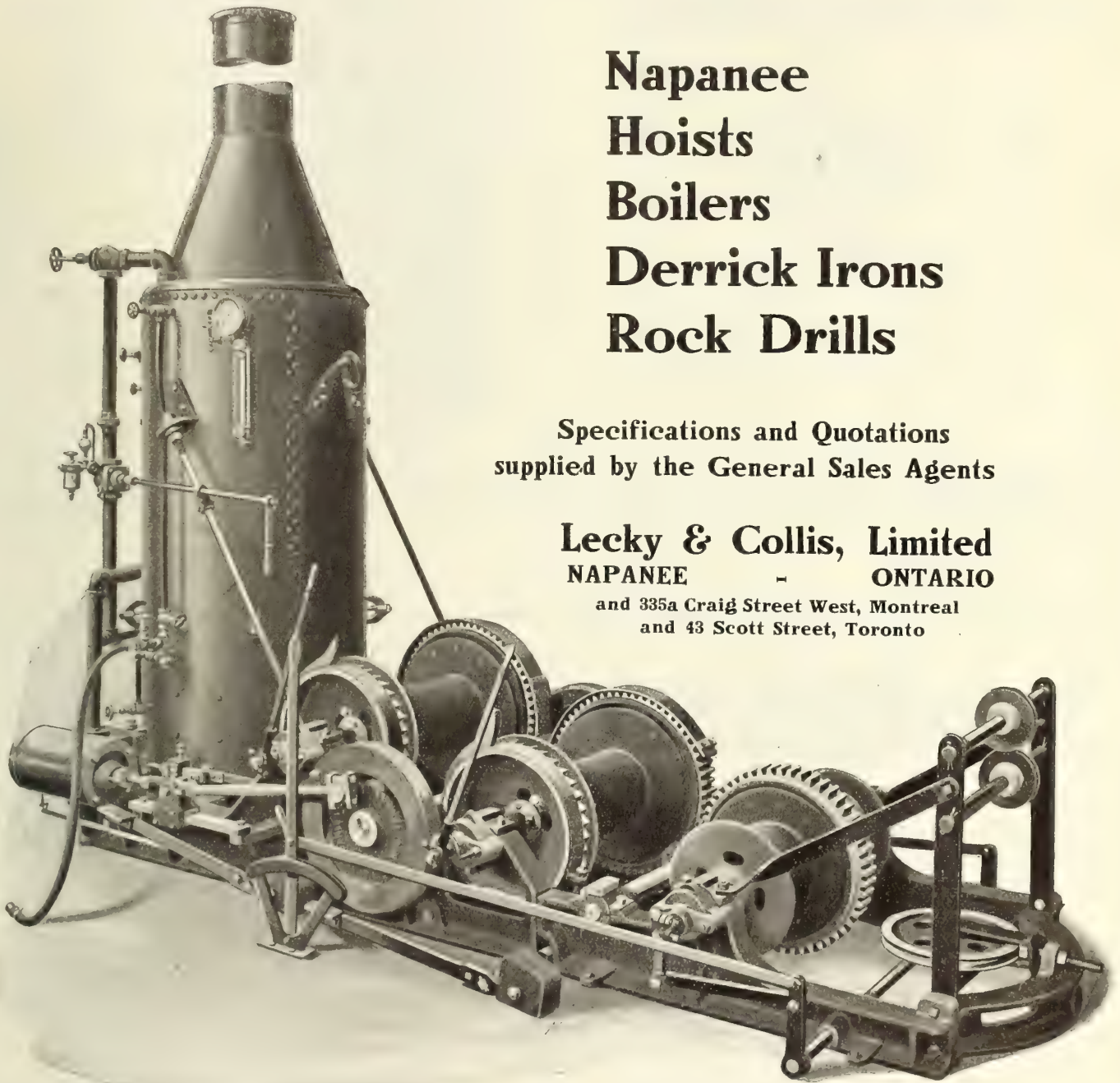
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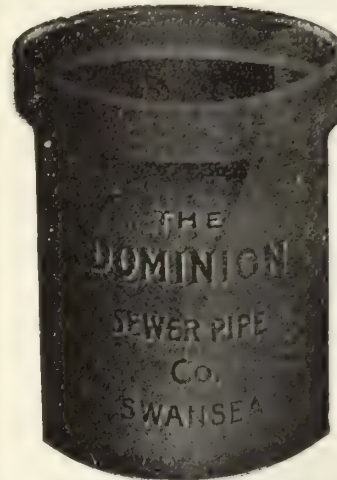


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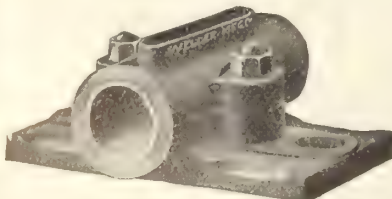
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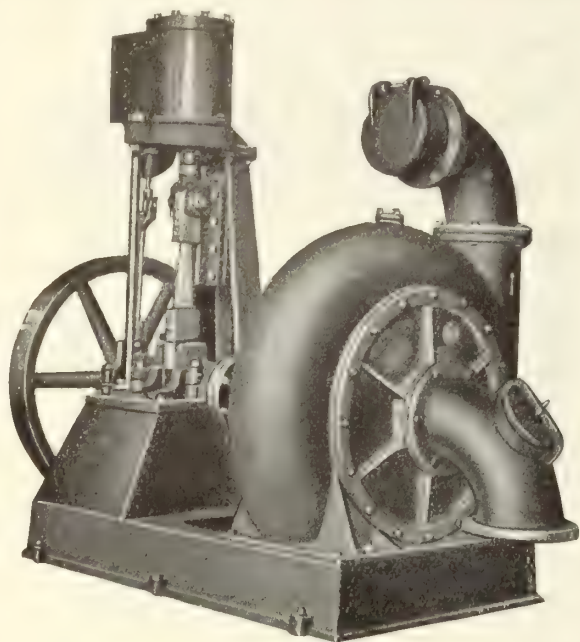
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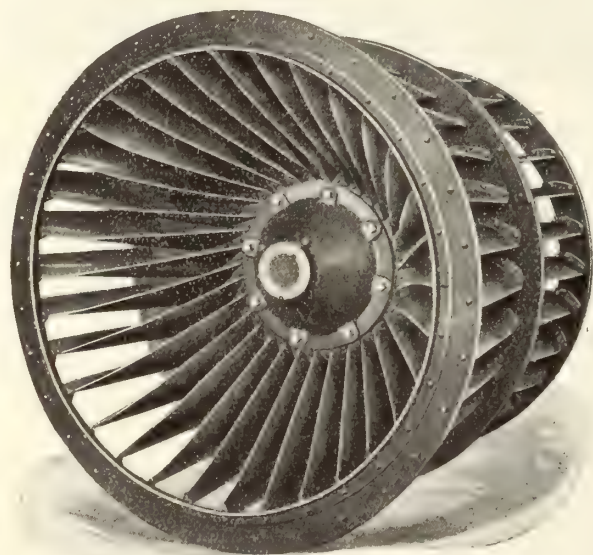
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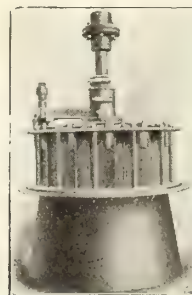


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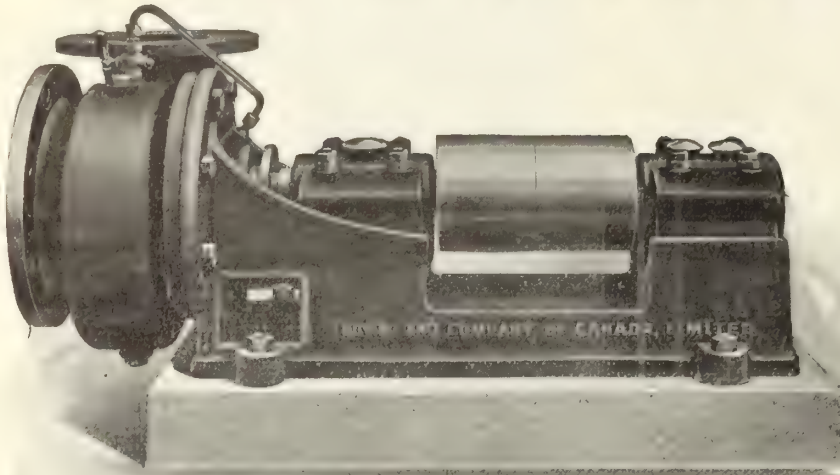


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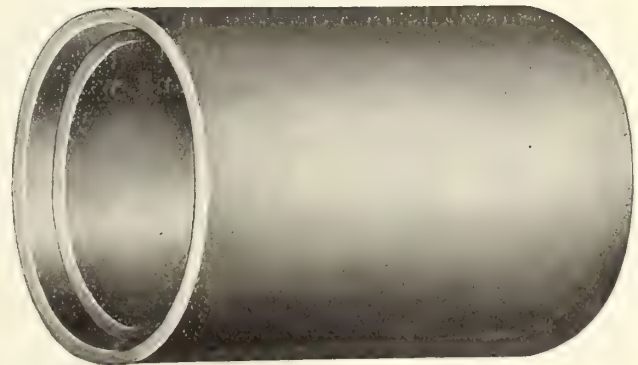
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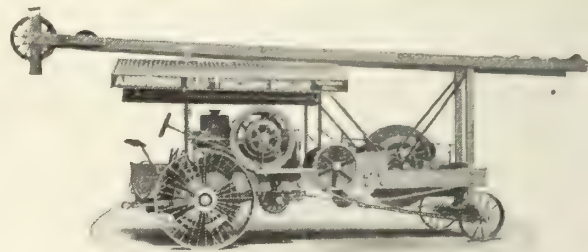
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at these two machines illustrated on this page. One is a Well Drill, the other a Special Blast Hole Drill. Little difference in the general design with the exception of the Spudding Beam ; but note this difference carefully.

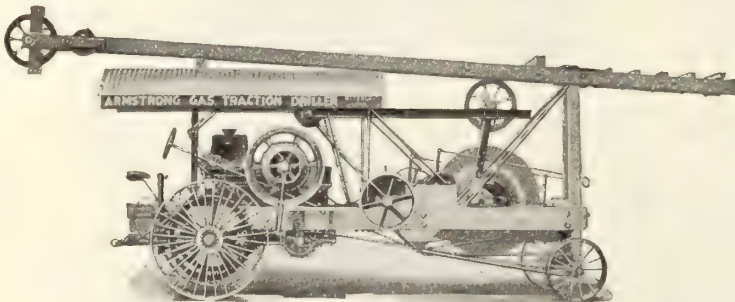
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Armstrong Water Well Drill



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The following figures indicate the respective gains or losses in building throughout the various provinces. The West has suffered most, only two cities showing an increase, while fifteen out of twenty-five Eastern cities have gained in spite of the general depression. The results should be encouraging.

		EAST		Inc.	Per Cent.
	12 Mos., 1913	12 Mos., 1912			
Berlin	\$ 647,571	\$ 834,213	\$ 186,742	22.3	
Brantford	1,015,886	1,167,105	*151,219	12.9	
Chatham	338,310	201,591	136,719	67.8	
Guelph	357,335	388,499	*31,164	8.0	
Halifax	835,850	589,775	246,075	41.7	
Hamilton	5,110,000	5,491,800	*381,800	7.0	
London	1,789,920	1,136,108	653,812	57.5	
Maisonneuve	2,454,923	2,685,828	*230,905	8.6	
Montreal	27,032,097	19,408,690	7,623,407	39.2	
North Bay	492,940	462,675	30,265	6.5	
Ottawa	3,991,380	3,621,850	369,530	10.2	
Outremont	1,819,000	1,582,000	237,000	14.9	
Peterborough	488,540	465,905	22,635	4.8	
Port Arthur	1,935,185	2,494,179	*558,994	22.4	
Preston	400,055	337,160	62,895	18.6	
Quebec	1,929,781	933,002	996,779	106.8	
St. Catharines	759,478	811,335	*51,857	6.3	
St. John	2,380,660	566,200	1,814,460	320.4	
St. Thomas	154,471	89,946	64,525	71.7	
Stratford	334,085	439,496	*105,411	24.0	
Sydney	321,198	656,111	*334,913	51.0	
Toronto	27,038,624	27,401,761	*363,137	1.3	
Welland	611,157	469,744	141,413	30.1	
Westmount	2,009,544	1,824,369	185,175	10.2	
Windsor	1,148,975	988,063	160,912	16.4	
WEST					
Calgary	8,619,153	20,394,220	*11,775,067	57.6	
Edmonton	9,242,450	14,446,819	*5,204,369	36.0	
Lethbridge	504,954	1,358,250	*853,296	62.0	
Medicine Hat	3,851,572	2,836,219	1,015,353	40.0	
Moose Jaw	4,225,000	5,275,797	*1,050,797	19.9	
N. Battleford	850,195	896,970	*46,775	5.2	
N. Westminster	958,975	1,634,518	*675,543	41.3	
Prince Albert	1,380,290	2,042,450	*662,160	32.4	
Red Deer	149,250	389,015	*239,765	61.6	
Regina	4,018,305	8,047,309	*4,029,004	50.0	
Saskatoon	2,633,845	7,640,530	*5,006,685	65.6	
St. Boniface	1,038,840	1,251,512	*212,672	16.9	
Swift Current	1,018,308	791,014	227,294	28.7	
Vancouver	10,423,197	19,428,432	*9,005,235	46.3	
Weyburn	177,400	766,660	*589,260	76.5	
Winnipeg	18,621,650	20,595,750	*1,974,100	9.6	
Yorkton	437,777	735,966	*298,189	40.5	

*Decrease.

Several hundred million dollars' worth of materials will be purchased by builders and constructors in Canada this year. Nearly every one of these is a possible customer for you. Are you sharing in these opportunities to the fullest extent? Are you getting in on the ground floor in time to compete with your competitors?

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to pass us by before getting our prices on your requirements or before putting in your tenders on

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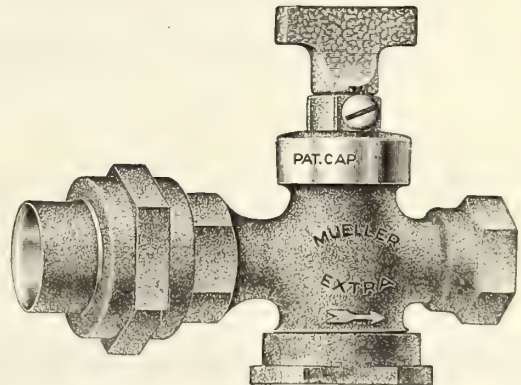
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fit right and wear well

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ANGLES— $\frac{3}{4}$ " x $\frac{3}{4}$ " x $\frac{1}{8}$ up to 2" x 2" x $\frac{5}{16}$ ".

CHANNELS— $\frac{3}{4}$ ", - $\frac{7}{8}$ ", - 1", and $1\frac{1}{4}$ ".

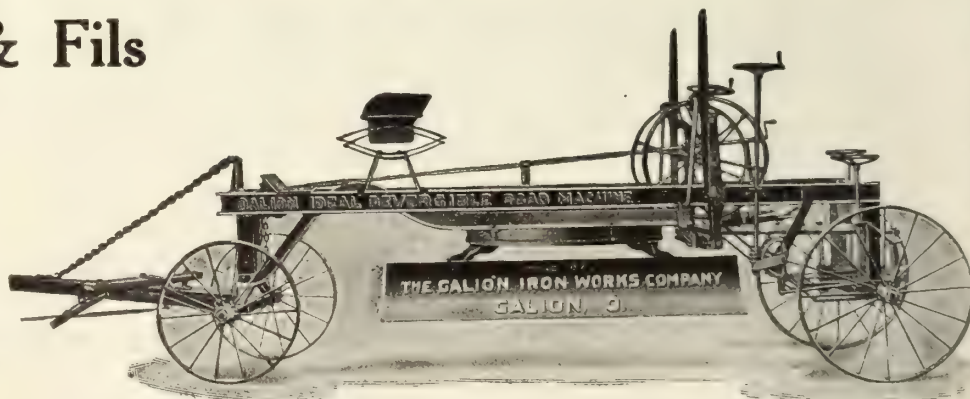
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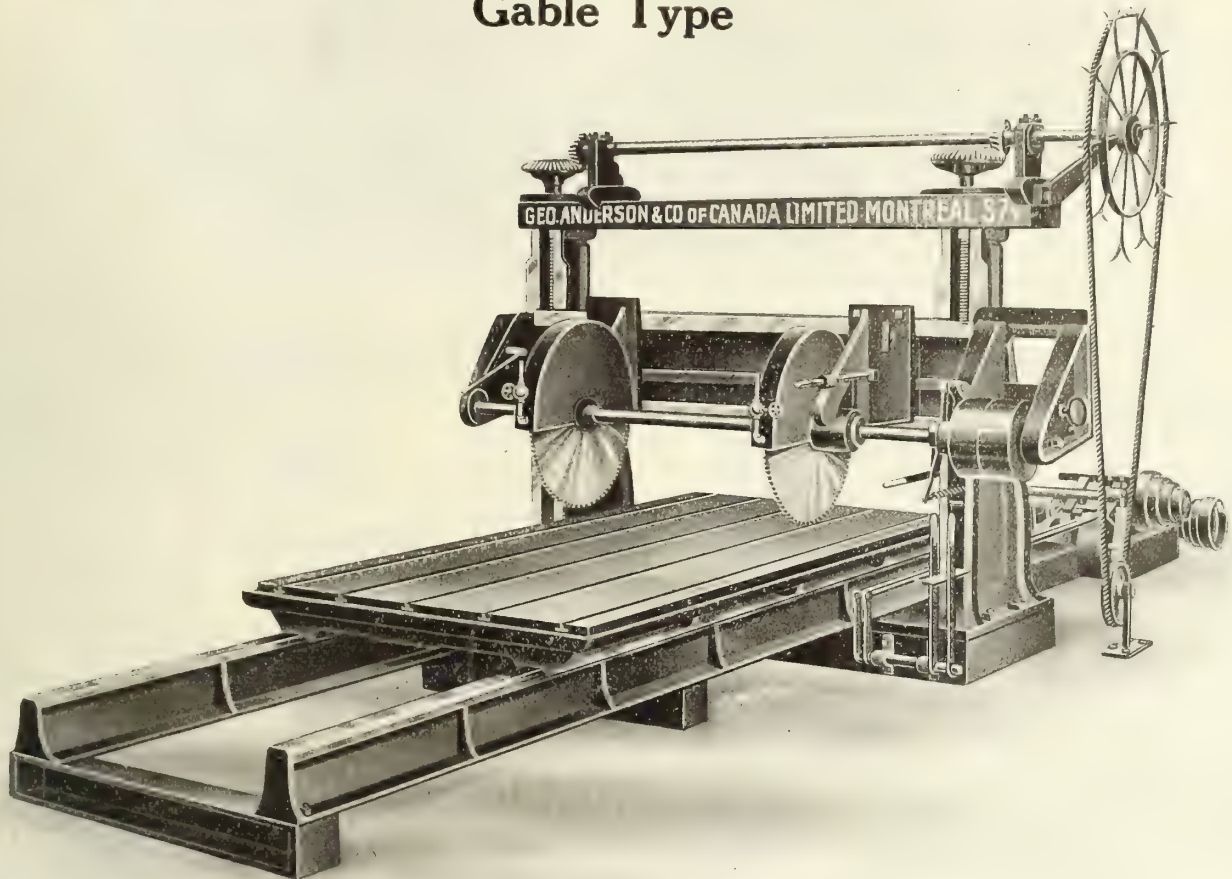
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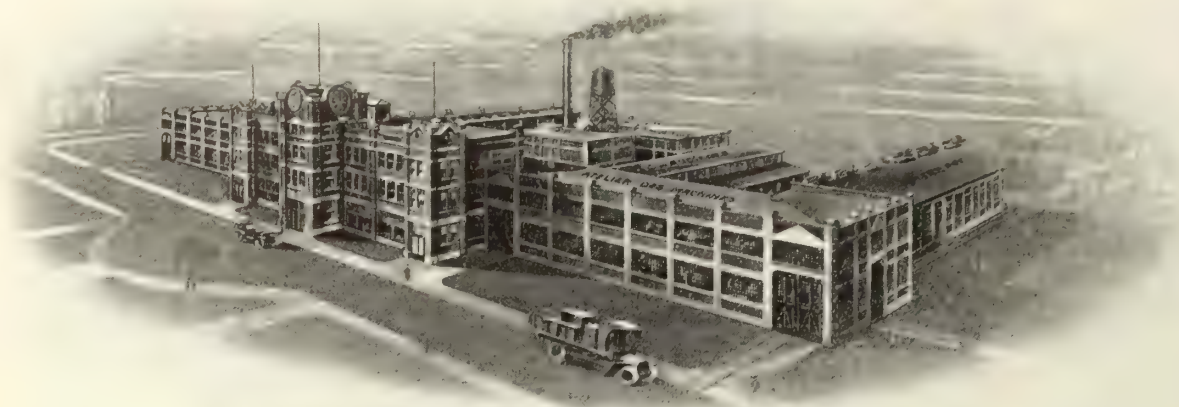


The cutting capacity of this machine, fully loaded, with fast feed speed is 160 superficial feet per hour.

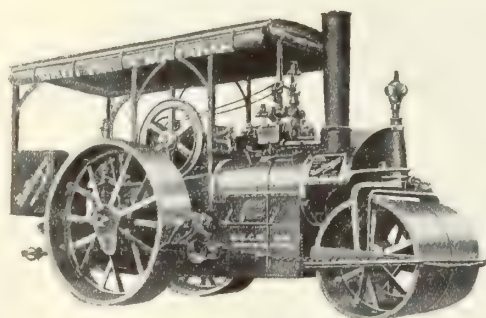
This machine is specially suitable for *Monumental Stones, Tiles, Details.*

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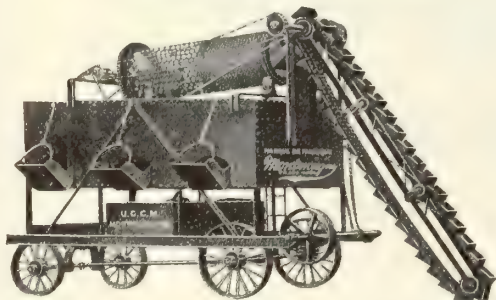
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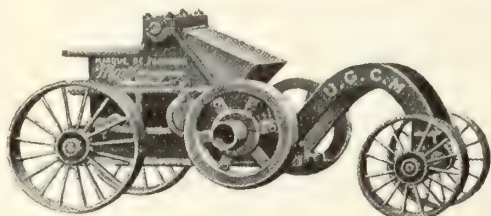
The Montmagny Plant.



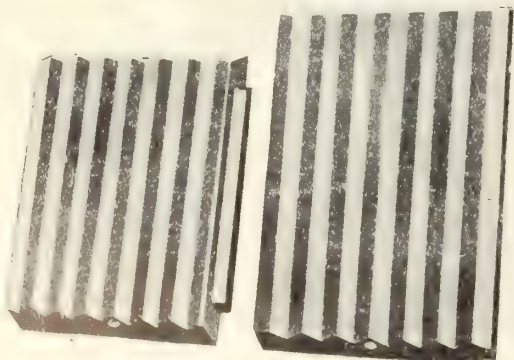
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"Montmagny" Portable Steel Bin.



"Montmagny" Stone Crushers.



"Montmagny" Manganese Steel Jaw Plates.

Our well known "Montmagny" steam road roller for gravelling and macadamizing has worked on many of Canada's finest roads.

Double Cylinder, Double Bunker, Double Water Tank. Made in 10, 13, 16 tons. Semi-Automatic feeding of the water.

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For crushing field stone, granite, etc., "Montmagny" jaws are made of manganese steel. They stand the wear. For softer rock, chilled charcoal iron jaws are used. They are less expensive. Jaws may be reversed to wear both ends.

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"Montmagny"

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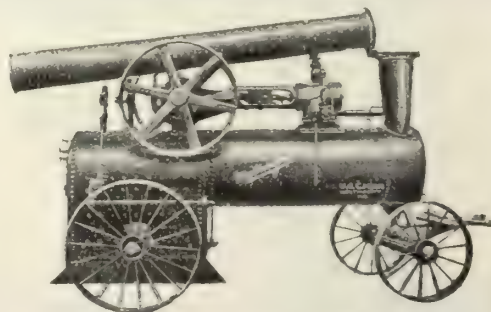
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"Montmagny" Road Sprinkler.

The "Montmagny" all-steel road sprinkler specially adapted to the building of macadam roads. Has horizontal perforated pipe discharge and is fitted with 4" cylinder feed pump and 2" suction hose.



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A portable centre crank engine and locomotive boiler mounted on wheels. Used for operating our "Montmagny" stone crusher or other machines. Made in 4 sizes, 15 to 30 H.P.



**Continuous
Bucket
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handling 300 tons per hour. Note the absence of tracks. The chains are guided by large flanged rollers. This is a heavy slow speed elevator, designed for long life.

STEEL BUCKET ELEVATORS

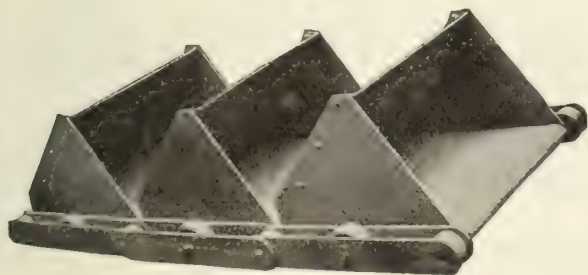
For Sand, Stone, Gravel, Etc.

For the contractor who is handling large quantities of sand, stone, gravel, and other rough material, a Waterous Steel Bucket Elevator will effect economies in time and labor that are worth consideration.

We build Elevators and Conveyors on the Link Belt System, in sizes ranging up to 600 tons per hour capacity, designed and arranged to suit special installations.

Years of experience building transport equipment are built into these conveyors. Send us your sketches and let us figure on a cost-cutting installation for you.

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Woolworth Building, New York

**The Entire Substructure of this Building
Successfully Waterproofed with**

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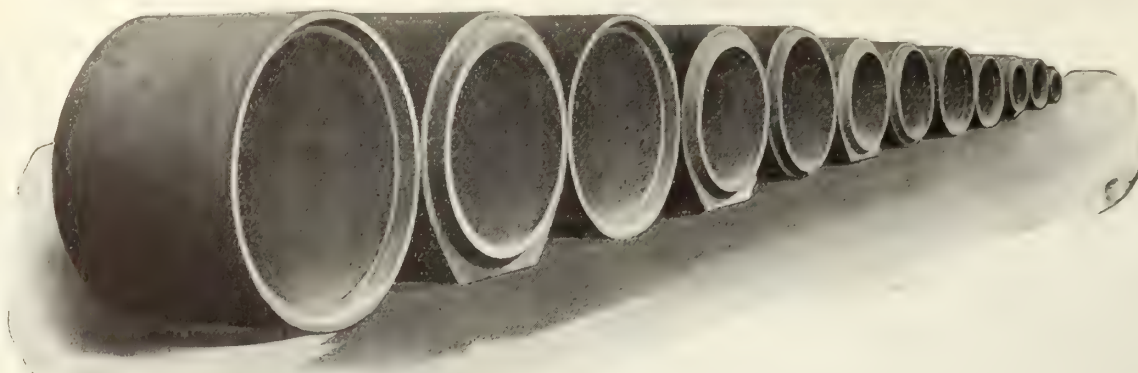
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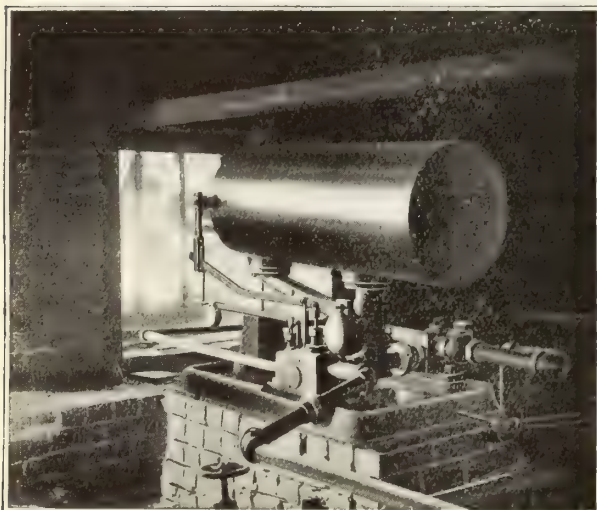


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Our concrete manufactures include a complete line of concrete pipes and building materials. Only the best Portland cement, clean sharp sand and crushed stone are used. These ingredients are proportioned to give the maximum strength and density to the finished aggregate. All our products are **steam-cured**, which method is the latest and most efficient known to science.

PRICES UPON APPLICATION.

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Detroit Return Trap at the plant of Fox Bros. of Windsor, Ont., draining steam lines of Lumber Dry Kilns

"Detroit" STEAM TRAPS

Return - Separating - Vacuum and Condensing

There is a Detroit Trap for every requirement of condensation handling. *Return Traps* automatically return condensation from steam lines **directly to the boiler** without pumping.

Separating Traps are used to Bleed live steam lines.

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Let us solve your condensation problem, write or wire for our steam trap specialist to call

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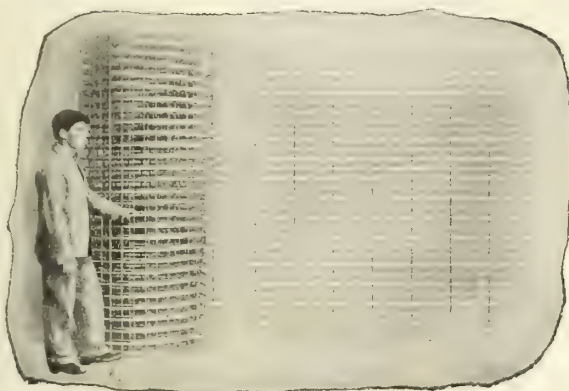
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605 2nd Street, Calgary

Its Remarkable Flexibility

makes it possible to adapt the

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to meet any requirements in the construction of floor arches.



CLINTON FABRIC forms a continuous bond from wall to wall and is heavily galvanized.

Made from wire of great tensile strength, thoroughly tested in process of manufacture.

The transverse member distributes the tensile wires evenly and accurately, all of which run along on the same plane in the concrete slab.

Intersections of transverse wires electrically welded at each intersection to longitudinal wires—Slipping impossible.

The intersection at the weld is of the smallest area—no possible voids in the concrete;

22,000,000 feet in Canada in 10 years without a single defect.

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THEW Shovels Dig Sewers Economically



Type O Thew Shovel on Sewer Work

the shovel operator, fireman, surface man, timber man, bottom levelers, fuel, water, etc. This makes the cost of finished trench 50c per lineal foot or 25c per cubic yard."

The owner of this shovel writes as follows regarding the work done with this **Type O Thew Shovel** in Detroit, Mich.:

"We excavated a trench eleven feet wide, ten feet deep and 6,000 feet long and hauled the material away at an average cost of 16c per cubic yard. I can not say too much in favor of the Thew Shovel."

A Los Angeles, California, contractor writes as follows:

"After completing the Hill Street tunnel, we equipped our **Type O Thew Shovel** with the special trench boom, dipper and dipper handle you built for us. The soil in this territory is a hard, tough, sticky black material which is quite difficult to handle by hand but is easily handled by the shovel.

"The shovel averages about fifty lineal feet of trench per day, three feet wide by twenty feet deep at a total cost of \$25.00, including

Write for Catalogue. We have a Shovel suited to your work.

The Thew Automatic Shovel Company, - Lorain, Ohio

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The Real Worth of a GOOD Dumping Wagon

ON the first concrete bridge constructed in Ohio to displace a bridge washed away in the Ohio floods of last year, many dumping wagons were employed in hauling sand and gravel for the concrete construction.

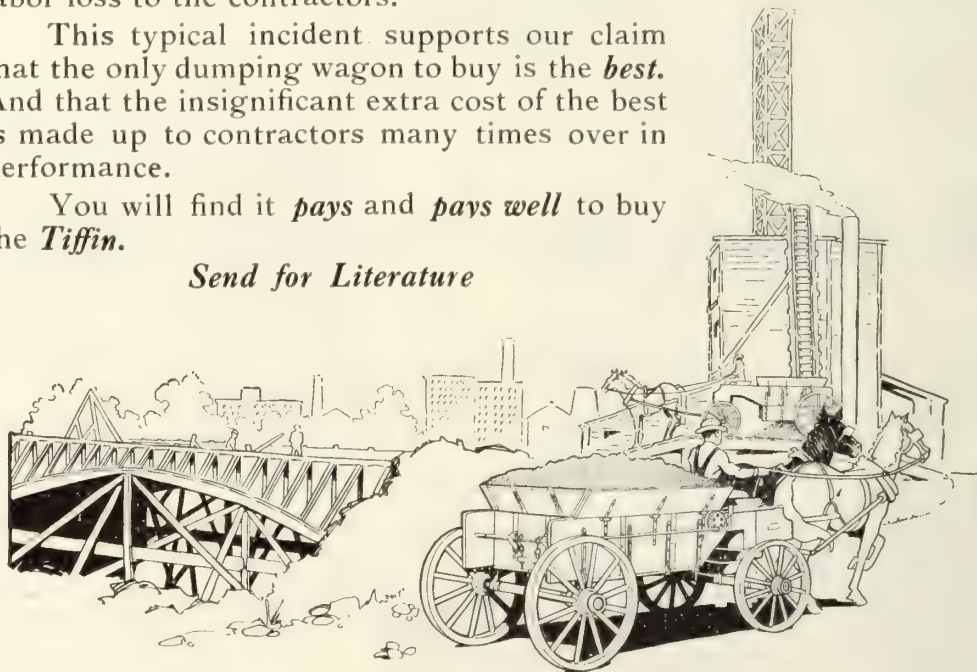
The dumping wagon equipment consisted in part of Tiffin wagons and also in wagons of other makes.

Tiffin Dumping Wagons performed their work without a moment's loss of time. Not so the other wagons whose dumping devices failed at times. Hundreds of laborers were kept idle for hours at a time because of the temporary failure of those other wagons. Result—a considerable labor loss to the contractors.

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You will find it *pays* and *pays well* to buy the *Tiffin*.

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Our raw material is ideal for our purpose. It is shale rich in iron oxide which give a fast and pleasing color to the brick.

Specify Hamilton Pressed Brick.

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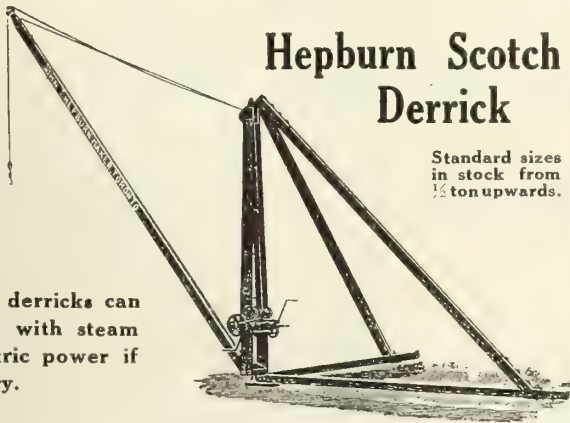
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IS USED ALL OVER THE DOMINION OF CANADA



**Hepburn Scotch
Derrick**

Standard sizes
in stock from
1/2 ton upwards.

These derricks can
be fitted with steam
or electric power if
necessary.



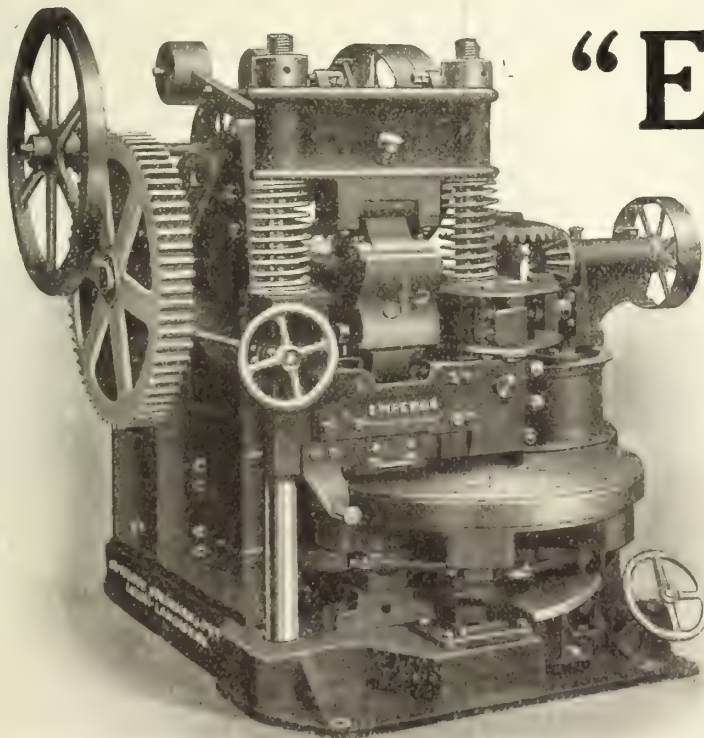
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Capacity 5 tons. Girders, Warren Braced Type.

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We can furnish complete
brick plants on the most
modern lines. Presses
for sand-lime, clinker,
clay and other bricks.

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& Co., Limited**

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Mr. Contractor:

When you want a foreman you employ a man experienced in your particular line of work. Why not do the same thing in handling your boarding camps?

If you are starting a new job we will design your buildings so that the work can be handled to the best advantage; if you have already started your camp we will take it over and operate it for you, and guarantee satisfaction. We are specialists in this work. Write us for proposition.

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HOPE STEEL SASH

A building equipped with Hope Steel Sash is an advertisement of enterprise and ability. The many special types of Hope Sash are each designed for a particular class of building. Because of the strong solid section, patented joint and adjustable double contact casement ventilators HOPE SASH OFFERS many practical advantages that mean satisfaction to your client.

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Let Us Tender on Your Roofing, Waterproofing and Flooring Specifications

We supply ROOFING, WATERPROOFING and INSULATING MATERIALS, and undertake contracts for Roofing, Waterproofing, Tar Rock, and Mastic Asphalt Flooring. Our Complete Equipment enables us to execute the work in accordance with Architect's and Engineer's Specifications.

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Waterproofing Made Simple



The New Times Building, Los Angeles, California. The basements were kept dust-dry, despite a constant condition of ground water pressure, by waterproofing the foundations with Ceresit. Architects, Kreple & Erkes, Los Angeles. Contractors, C. Leonhardt Co., Los Angeles.

Pour one part Ceresit into one part water. Ceresit, a milk-white paste of the consistency of slightly melted butter, readily dissolves in the water.

Add eleven more parts of water, thus making a proportion of one part Ceresit to 12 parts water.

Use this water then for mixing the concrete, cement mortar, or stucco—as the case may be.

Simple, isn't it? No expert labor needed. No extra labor, either, for the laborer who mixes the batch can easily put in the proper proportion of Ceresit.

The result is a perfectly waterproofed building material. After drying and setting, the concrete, cement mortar, or cement stucco is—

1—Absolutely and permanently moisture-proof.

2—Absolutely and permanently hydrostatic pressure-proof.

By keeping out the dampness which causes alternate wetting and drying, expansion and contraction, Ceresit prevents disintegration.

If you have not already sent for the complete facts regarding Ceresit, you'll find it decidedly worth your while. Write for our "Book of Evidence."



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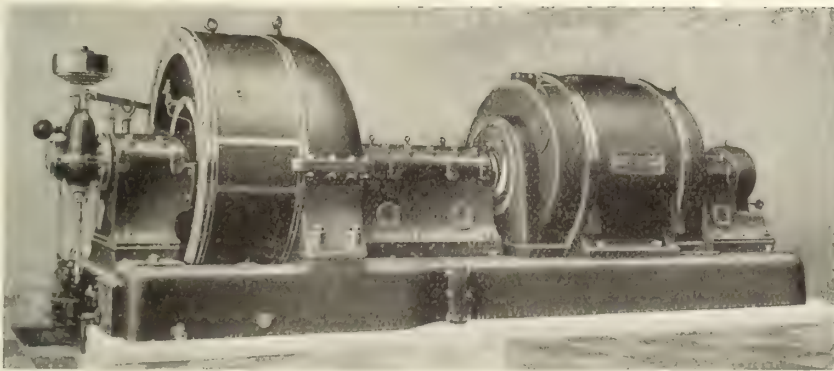
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Adamson-Rateau Steam Turbines



Installation for Dominion Coal Co. at Glace Bay, N.S.

**TURBO-BLOWERS,
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PUMPS, ETC.**

There is a total of 13,000 H.P. Adamson-Rateau Turbines running in the Dominion of Canada. These consist of High, Low, Mixed and Bleeder Turbines, Driving Blast Furnace Blowers, Pumps and Generators.

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Steam Turbines, etc.

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The
Manitoba Bridge & Iron Works

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—MANUFACTURERS—

Roofs, Steel Buildings and Structural Iron Work
 of all descriptions

ANNUAL CAPACITY, 20,000 TONS

Railway and Highway Bridges

6,000 tons of Beams, Channels, Angles, Plates, Flats and Bars always in stock at our works for **QUICK DELIVERY**, plain or fabricated.

Designs and estimates promptly furnished.

We also operate a **Large Grey Iron Foundry**, Annual Capacity 5,000 tons
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Office and Works

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Fred Holmes & Sons, Limited,
 Contractors.

Sun gray stock bricks were used to face the side walls and back of this large building —Shea's New Hippodrome.

Sun Bricks were also used for much of the interior work. Sun Bricks are hard, dense and uniform in size, color and quality.

Let us
 quote
 you.

SUN BRICK COMPANY, LIMITED
 Traders Bank Building **TORONTO**

Contract Record

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The Eloquence of Millions

Of all the praise that has been bestowed upon the city of Toronto during recent years, none is more eloquent than the statement that during the next six years no less a sum than \$230,000,000 will be expended in engineering and building works classified under six headings.

The greatest expenditure will be under the heading of new buildings. We may exclude the Union Station and estimate that Toronto's average annual expenditure during the next six years will be \$30,000,000. This gives us a first total of \$180,000,000. Second place is taken by the Harbor Commission's improvements, which will involve the expenditure of \$24,000,000. The third place in the list is occupied by the water-front viaduct and the new Union Station, which will cost not less than fifteen and a half million dollars. To the water-works plant at the east end of the city is assigned the sum of \$6,700,000, while the amounts opposite the Bloor-Danforth viaduct and the filtration plant additions at the Island are \$2,500,000 and \$1,300,000 respectively.

These six items, which aggregate \$230,000,000, constitute, of course, the greater part of the city's constructional activities—but much remains: there will be a considerable outlay upon sewers, pavements and other work—three sewer systems alone will cost \$7,000,000—moreover, maintenance charges upon various public works must be taken into account. Perhaps a fair estimate for the six years would be \$300,000,000—an average of \$50,000,000 a year.

Such expenditure provides the most convincing argument as to the development of Toronto. And what is taking place in Toronto is going on in lesser or greater proportion throughout the length and breadth of the country, in spite of the recent financial depression. It is of interest to note that the turn-over of Toronto's civic treasury last year was well over \$100,000,000, as compared with \$40,000,000 in 1909. The Queen City is fast becoming a metropolis—a consideration which should bring with it a measure of gratification to the constructional interests at large.

From the engineer's viewpoint, greater scope for professional ability will be found in engineering works on a greater scale, and from the contractor's viewpoint greater returns will accrue from the same percentage of profit on larger contracts, given the ability to finance them.

As our large cities assume metropolitan dimensions and responsibilities, so they will afford greater possibilities for those identified with their constructional enterprises. Toronto is a conspicuous example of a city that is growing out of a city into a metropolis and carrying with her to success the men who have built her up.

In constructing the deep pressure tunnels of the Catskill Aqueduct for the water supply of New York City many rock fissures had to be grouted. The most difficult piece of work of this kind was at the Hudson River siphon, 1,100 ft. below tidewater. About 150 ft. from the east shaft the heading cut a water-bearing seam, discharging about 300 gal. per minute. The full flow did not develop until the cut was blasted. It then became necessary to grout against a hydrostatic pressure of 500 lb. per square inch with no solid rock to which the grout pipes could be connected. This problem was finally solved by building a concrete bulk-head 8 ft. thick across the heading. The

concrete for this bulkhead was of 1:2:4 mixture, and was heavily reinforced with rails set into holes drilled laterally in the sides, roof and floor of the tunnel. Grout pipes leading into the fissure were set through this bulkhead. After the concrete had set for a week

grout was forced into the fissure first by the pneumatic process with a high-pressure air compressor and finally with a high-pressure plunger pump forcing water instead of air into the grout tank. Pressures were reached up to 1,000 lb. per square inch.

Are Architectural Competitions in the Best Interests of the Profession?

COMPETITIONS, architectural and otherwise, are defended on the ground that they bring out talent—that they distribute opportunity equally between those who have had the good fortune to come into prominence and those who have not. That there is a certain amount of truth in this argument cannot be gainsaid, but it is doubtful—whatever degree of truth the argument may contain—whether anything can be said to counterbalance the objection to architectural competitions on the score of their cost to the profession. The inspiration for our observations arises out of an inspection of the forty-one sets of designs submitted in connection with the new Masonic Temple building and recently placed on exhibition in Toronto. Here it is fair to estimate the total cost to the competitors at from fifteen to twenty thousand dollars—an amount practically equal to the fee which will be collected by the successful architect for his entire services in connection with the erection of the building! Such an estimate forces one to the conclusion that while competition of a kind may be a good thing and while it may be commendable to try and bring out latent talent, the cost entailed should be the governing factor.

After all, one does not have to look very far for an alternative. In our opinion, by far the better procedure—both in the interests of the profession and of the prospective owners—is to select carefully a man who has shown marked ability to grasp constructive problems of design. In the case of the Masonic Temple building the committee having the matter in hand might have agreed upon such a man and taken him into their confidence. At least one or two of their number might have travelled with the architect to see other buildings of a type somewhat similar to the one desired, the studies having been continued until the solution to the particular problem in hand was arrived at. As it is, the competitors in this competition have

been working in the dark—shooting arrows at a venture, and none of them has fully solved the problem. Even the “successful” candidate—the man awarded first prize—has to revise his plans considerably after a careful consultation with the committee.

As a matter of fact the history of competitions, architecturally and otherwise, has not been particularly encouraging. In few cases have even the first awards established a man permanently in the hall of fame. The limelight is turned on for a day and then frequently he is seen no more—not possessing the breadth of vision and experience to meet the demands and live up to the reputation of such a high status.

Competitions might be conducted successfully on a modified scale, perhaps, but the expense entailed in such a case as that cited in this article is altogether disproportionate, and, in our opinion, not calculated to promote the best interests of either the architectural profession or those desirous of obtaining the best ideas that the architectural profession has to offer.

When one reflects upon the system adopted by the Dominion Government in obtaining designs for the new departmental buildings at Ottawa, one is inclined to commend the procedure followed. Sketches drawn to a small scale were invited and from the list of competitors a few were selected for the final competition. These few were all paid for the work.

Architectural competitions are disappointing. Frequently there is disagreement over the sketches and a compromise is effected which leaves the best man out of it. We cannot but think that the rising generation of architects will be better advised to perfect themselves in a skilful blending of the art and practice of their profession by a more direct method than competition affords. Much of the inefficiency found to-day in the architectural profession may be attributed to time wasted in looking for royal roads to success—ephemeral success at best.

Banner Year for Road Work in Nova Scotia

NOVA Scotia is going to have the greatest year for road work in its history, according to details furnished the Contract Record by Mr. W. S. Yorston, Assistant Road Commissioner for the province. It is anticipated that a total sum of \$600,000 will be spent in the various sections of the province. The largest expenditure previously made was \$400,000 in 1913.

A yearly increase of fifty per cent. will soon place the province of Nova Scotia in the front rank of the road-builders of the Dominion and it reflects creditably upon the authorities, and speaks well for the fulfilment of the optimistic predictions that have been made concerning the maritime provinces, that such enterprising development schemes are under way.

At a time when engineers and manufacturers alike may well be devoting increasing attention to this section of the country it is interesting to learn from Mr.

Yorston that of late the annual expenditure on the roads of the province has been upwards of \$400,000. One-half of this amount is in the form of statute labor, commuted and uncommuted, and the balance is contributed out of revenue by the government of the province and expended on the roads in the different counties under County Inspectors.

The whole of the road expenditure is administered by the Road Commissioner, with head office at Halifax. A recent amendment of the Highway Act in 1907 provides for the appointment of the Road Commissioner, Assistant Road Commissioner, and the necessary staff of assistants for the proper carrying out of the road work in the province.

Reports of all work required to be done in the different counties are made by the County Inspectors and sent in to the office for approval. If approved of, an authority is issued covering the estimated cost of

the work. The responsibility for carrying out the work devolves on the County Inspector, who finally passes the work before the pay-roll is sent in and payment made.

In addition to the assistance given to the roads out of revenue, an Act entitled, "An Act to Provide for the Betterment of Highways," was passed last year. This measure provides for an expenditure of \$10,000 in each county of the province, for the betterment of highways. In addition, there was also passed last year an Act entitled, "The Motor Vehicle Act Road Improvement Fund." By this Act all monies paid as license fees by motor vehicles, are diverted to the roads of the province to be applied to the main arteries. The licenses at present paid into the provincial treasury amount in the aggregate to \$13,000 yearly.

In addition to the above spending Acts, the Legislature has recently passed an Act to further amend

the Highway Act relating to the expenditure of provincial roads and bridge grants. This is an Act providing for the maintenance of the roads by patrolmen. It is only now being put into force, but it is intended to continue the appointment of these patrolmen as fast as organization can be affected. From results already obtained it is thought that this Act will be particularly useful.

Although expenditures under certain sections were commenced in the fiscal year 1913, the bulk of the expenditure to be made under these Acts will come in the year 1914, the necessary surveys and reports for the work having been in large part made preliminary to the starting of the work.

Mr. Hiram Donkin, C.E., Halifax, is Road Commissioner and Provincial Engineer for Nova Scotia. Mr. W. S. Yorston, Halifax, is Assitant Road Commissioner.

The Application of Business Methods to City Government

By Henry M. Waite, City Manager of Dayton, Ohio.

THE most recent development in municipal administration at Dayton has been the commission-manager form—the application of the business organization of successful corporations to municipal government. In this form we elect our commission, which in turn selects a business manager for the city; he chooses the heads of the various departments. The commission in a corporate organization would represent the executive head or the president of the corporation. In Dayton the organization of departments is on the pyramidal form and is based on five as the ideal number. We have five commissioners as the legislative body who employ the city manager, and under the city manager there are five directors at the head of the five principal functions of government—namely, service, safety, welfare, finance and law. These are selected and appointed by the city manager.

Here is the first and principal application of business methods to city government. Under the old form we voted for the heads of the various departments. It would be just as reasonable to expect a corporation desiring to fill a particular vacancy in its organization to go out and ask the neighborhood to vote on some one to fill that particular place. When a private corporation desires to fill a particular vacancy in its organization it selects the man who it believes will perform those particular functions with the greatest economy and efficiency, and the salary paid is in accordance with his worth to the particular business desiring his assistance, no other ties or conditions being considered.

Dayton elected as commissioners five solid, successful, brought-up-from-the-ranks business men, who in turn employed a manager whom they believed, because of his record, could fill the position. The manager after a careful study of the situation has chosen his directors from material available in Dayton, with one exception.

The director of welfare has charge of health, parks, playgrounds, charities, corrections and social betterment. The man now in office has made this work a study, having spent several summers abroad observing the social conditions in foreign cities, as well as having conducted similar studies in this country.

The director of finance is at the head of the ac-

counting, financial and purchasing departments. The man selected has spent much of his life as treasurer, auditor and in the purchasing departments of manufacturing in Dayton, and the latter years have been spent as a public accountant.

The city attorney's duties are self-evident. He is one of the leading attorneys of Dayton, who was willing to sacrifice his own business interests to accept the position.

The director of service has charge of the water-works, all engineering, contracts, maintenance of streets and sewers, the handling of garbage and ashes, and supervision of all public utilities. The man holding this position has had experience in large construction work and municipal work and was my principal assistant engineer in Cincinnati.

The director of safety has charge of the police and fire departments. This position has not yet been filled, and the duties are being taken care by the city manager.

It is impossible for me to tell you about the political faith or inclination of any of the appointees above mentioned, nor is it possible for me to tell you the political faith of any appointees whom I have named since I have been in Dayton. We simply insist on three requisites—efficiency, economy and loyalty.

In all public work we are confronted with the idea that is grounded in the minds of most men that they do not have to do as much work nor do they have to take as much interest as they do in individual or corporate concerns. Civil service likewise does not produce ideal results from an operating standpoint. But we believe that better results can be obtained under the commission-manager form than under the older forms, due to a more efficient method of selection and removal by the application of our successful business methods to our municipal government.

Patches in concrete pavements at Fond du Lac are covered with a one-half-inch layer of asphalt as soon as laid to protect the surface until it gets its final set. The asphalt will not stay permanently, but will protect the surface for two or three weeks, and as a result one can hardly detect the patches except by the variation in color.

Modern Highway Bridge Construction

Adaptation of Type to Location an Elementary but Important Consideration—Conclusions from the Experience of Hastings County, Ont.

By Lucius E. Allen*, Belleville, Ont.

BOTH in Canada and the United States public attention is being turned to the importance of good roads. Railway construction has had in the past, and still has, an important place in the development of trade and commerce, but it is now generally acknowledged that the improvement of our public highways is as essential to the growth and progress of the country as the construction of railways, and that with the construction of so-called permanent roads, the construction of permanent bridges bears an important part.

Before referring to modern practice in bridge construction, it may be of interest to refer briefly to the fact that practically less than one hundred years have elapsed since highway bridges—on this continent at least—assumed practical proportions and began to receive the attention of engineers and bridge-builders. The early bridge builders in this country used timber as the material and followed out the types developed by Burr, Palmer and Towne, who introduced the wood-

concrete reinforced with steel are the predominant materials in use for bridge construction.

In the construction of a bridge there are certain essential requirements and principles that must be adhered to in order to secure satisfactory and permanent results. I shall endeavor to outline briefly the fundamental requirements.

Adaptation of Type to Location

There have been many "misfits" in bridges, and one of the first and most important steps in the building of a bridge is a careful study of the location, having special regard to the type of bridge best adapted to the particular location. The main points upon which to base a decision as to the best type of bridge to construct to suit the locality are:—1—length of span and height; 2—character of river or stream; 3—character of foundation.

Whether steel or reinforced concrete have been decided upon, the length of span and height above high water must be carefully considered. If the span be less than sixty or seventy-five feet, a low truss steel construction is usually used; if eighty or 100 feet, the high truss is usually used. It is also essential to consider whether two shorter spans with a pier in the centre are more economical than one long span, which is governed by the height and size of piers required.

The same conditions apply if reinforced concrete construction be desired. Up to 40 to 45 feet the girder beam type of reinforced concrete is usually simpler and less expensive to build than the concrete arch, and it may be possible and more economical to divide the total span distance into a series of reinforced concrete girder beam spans of 40 to 45 feet each.

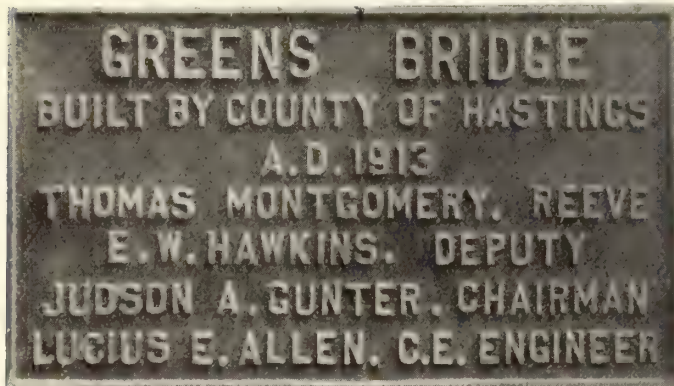
Character of River or Stream

Due regard should also be given to the character of the river or stream over which a bridge is to be constructed. If the current be rapid, and the water of some depth, the cost of constructing piers in mid-stream is increased very largely, and the one-span type is preferable. On the other hand, if the stream be shallow and the foundation good, the cost of pier construction is greatly reduced.

Character of Foundations

In selecting the best type of bridge to build, too much care cannot be given to the character of the foundations available at the bridge site. For important structures it is absolutely essential that the character of the foundation be determined by careful test. This may be done by digging a test pit or by driving iron rods or heavy iron pipe. When these methods do not prove the foundation satisfactory a wash-drill outfit may be used. This consists of a drill point to which is coupled one inch iron pipe in 4-foot lengths. Water is forced through the pipe by a hand force pump, which washes the material up through the pipe.

It is not advisable to use the reinforced concrete arch when the foundation conditions are not of the best. A steel bridge resting on two concrete abut-



Bronze bridge plate attached to all new bridges by the County of Hastings.

en latticed truss, usually covered. Various examples of such structures may yet be seen.

It was not until about 1850 that cast iron was first introduced by Whipple. This material was succeeded some years later by wrought iron. Steel, the material now universally used in steel bridge construction, did not come into general use until about 1875. From its use, due to its great tensile strength, the modern development in bridge construction received its greatest impetus.

The use of cement as a material for bridge construction is of comparatively recent date, although cement was apparently used by the Romans. The first concrete arch was constructed of plain concrete in 1869 and is known as the Grand Maitre bridge, at Fontainebleau Forest, in France. This arch has a span of one hundred and sixteen feet. In 1871 a plain concrete arch of thirty-one feet span was constructed in Prospect Park, Brooklyn, New York. It was not until the construction of a reinforced concrete arch in San Francisco, in 1889, that iron or steel was first used in connection with concrete. At the present time, steel and

*Consulting Engineer. Engineer to the County of Hastings, Ontario.



Glenn Ross bridge, containing five 95-ft. spans, erected by the County of Hastings

ments, will allow of some movement or settlement of the abutments without injuring the strength of the structure, although it is essential to allow a liberal factor of safety in the size of the footings, so as to give sufficient bearing power to sustain the bridge under maximum load without any settlement.

Design and Preliminary Plans

After a careful survey of the bridge site has been made and the character of the foundation determined,

apply equally in the designing of highway bridges. One factor in the building of municipal bridges which led to the construction of many poorly-designed and weak bridges was the all-too-prevalent custom of allowing each bidder to submit his own plan and design, the result being that the municipality purchasing the bridge, without expert advice, naturally let the work to the bidder submitting the lowest price. This practice, however, has in a large measure disappeared, owing to the requirements exacted by the Ontario Pro-



Catholic church bridge, a 45-ft. reinforced concrete arch which cost \$1,400.



The Seymour bridge, one 30-ft. span, erected at a cost of \$865.

it is then possible to decide on the best type of bridge. There are several types of steel and reinforced concrete bridges any one of which may be selected to best suit the particular location. The expression which is heard so frequently these days in connection with the operation of railroads, "Safety First," should

vincial Government, through its regulations and general specifications, under which all county bridges must now be built.

The design and plans for a bridge whether of steel or reinforced concrete should be carefully prepared and checked by the engineer. If the bridge be of steel,



The Frankford bridge erected by the County of Hastings. Total length 500 ft; 16 ft. clear roadway; sidewalk on one side; reinforced concrete floors; approximate cost \$39,000.



The Boundary bridge, County of Hastings, two 95-ft. skew spans.

an inspection of the truss and its connections should be made in the shops by the engineer, particular attention being given to the rivetting and painting.

If the bridge be of reinforced concrete, the steel reinforcement should be checked from the plan. During the course of construction a careful check should be made of each bar as it is put in place, as it is evident that after a concrete bridge is once completed there is no way in which to remedy a mistake in placing the reinforcement.

Construction of Bridges by Municipalities

There are two ways in which bridge work may be carried out in municipalities: the first is by letting all work by public contract, the second by organizing a competent construction force under the direct supervision of municipal officials. Where the amount of work is not very extensive and does not warrant the expenditure required for machinery and equipment necessary for carrying out the work, the contract system is probably the better; but where the work is sufficiently large the county-operated system, in my opinion, is the better system. As the County of Hastings has developed this system to a large degree, I shall outline its development and method of operation.

At the beginning of the year 1910 Hastings County had some 250 bridges, nearly all of them being old wooden structures. Several of these bridges had failed, killing a number of people and costing the county large sums for damages and repairs. On the adoption of a report presented by the Chairman of the Roads and Bridges Committee in 1910, the present system of bridge construction was inaugurated. The pro-

COUNTY OF HASTINGS Daily Report of Bridge Construction To LUCIUS E. ALLEN, C.E., COUNTY ENGINEER, BELLEVILLE, ONTARIO

Report No.
Date.....
Bridge.....
Post Office

I beg to Report as follows as to progress of work for day ending 191 ...

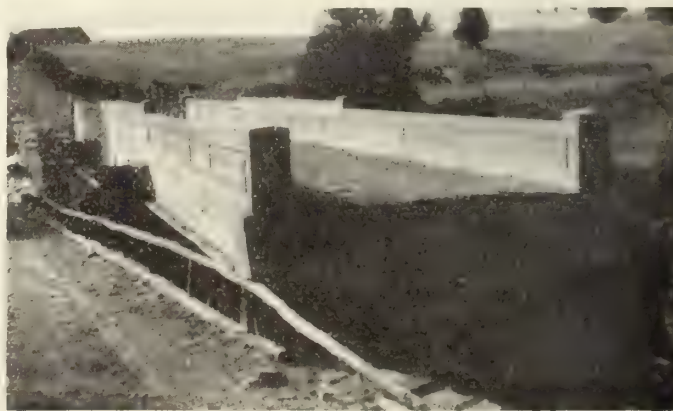
- 1 Total Number of Men Employed
- 2 Total Number of Hours for day
- 3 No. of Laborers Employed
- 4 No. of Carpenters and helpers
- 5 No. of Teams Employed
- 6 Total amount of Pay Roll for day, \$
- 7 Estimated amount of Excavation or Fill
- 8 If Cofferdam or Pumping is required, state to what extent
Cement
- 9 Proportion of Concrete, Gravel
Rubble
- 10 No. Batches Concrete as above
- 11 No. Sacks Cement used
- 12 No. Barrels Cement on hand
- 13 Quality of Gravel or Sand
- 14 Condition of Weather and Temperature
- 15 State nature and general progress of work for day
- 16 Information or material required

Foreman

County of Hastings—Daily Progress Report.



An old structure which the County replaced last year by a reinforced concrete arch.



Glenmire bridge, consisting of three 45-ft. spans erected by the County of Hastings.

gramme of construction, as laid out, being a large one—involving an ultimate expenditure of nearly \$500,000—methods of handling the work economically and efficiently were essential. The following general plan has been followed.

At the beginning of each year, an inspection is made of those bridges that appear to be the most dangerous to public safety, and the year's work is subsequently laid out. The council, appoint, at the beginning of each year, a special Bridge Committee which is in direct touch with the work through its Chairman and engineer. The actual construction work is carried out by several gangs of men, each of which has a competent foreman who is held responsible for the hiring of the men and their general efficiency. The Chairman and the Engineer make frequent inspections of the work as it progresses. The foremen are required to make a daily report in writing to the engineer covering the essential details of the work, materials or information required, and at the end of each month the engineer checks the pay-rolls from the daily reports for the preceding month. During the year 1913, six bridge gangs were employed. Each gang is supplied with a complete camp equipment, which reduces to a minimum the so-called "high cost of living" of the men. A complete equipment of the necessary machinery is provided. This equipment consists of three Wettlaufer half-yard concrete mixers, concrete wheel carts, pumps, excavating tools, etc.

Local material is used when it can be secured of the right quality. The superstructures of all new steel bridges constructed within the past four years have been designed to meet Class "C" of the Provincial Government General Specification. The substructures for steel bridges are constructed by the county bridge gang. The plan followed in calling for tenders for steel bridges has been for the engineer to prepare the required plans and submit these to all companies tendering, so that uniformity in design has been secured. Reinforced concrete floors have been specified in all cases and have proved very satisfactory, requiring no repairs. In most cases a surface covering of 4 to 6 inches of gravel has been put on the bridge floors over the concrete. This protects the concrete and also tends to hold the snow in winter better than a smooth concrete surface.

The form work for reinforced concrete bridges is made up from two-inch lumber surfaced on one side and two edges, and is used at least twice. Portland cement is distributed in car lots to the nearest railroad station. During the year 1913 over six thousand barrels were used in bridge work.

In the past five years, in Hastings County, sixteen steel bridges, with approximate total span length of over 3,000 feet, have been erected at a cost of some \$155,000, and forty reinforced concrete bridges, with a total span length of approximately 1,900 feet, have been built at a cost of some \$83,000.

Conclusions

There are several essential points in the construction or planning of highway bridges which should have the careful consideration of municipalities having work of this nature in view.

1.—Each year a municipality should make a careful examination and survey of all bridges, with regard (a) to their safety, (b) to their state of preservation and repair, and (c) to the character and amount of traffic in each case.

2.—A systematic plan and organization of the work

required to be done by the county or municipality should be made in advance, before any public catastrophe, due to bridge failure, can occur.

3.—The execution of such work should be delegated by the municipality to a competent official whose engineering qualifications and experience are a guarantee of proper and efficient construction methods.

4.—After a bridge has been constructed, especially if the superstructure be of steel, great care and attention should be given to the preservation of the structure by keeping it properly painted at regular intervals.

5.—Before proceeding with the design and construction of a bridge, future traffic conditions should be considered. The length and height of span above present high water should also be taken carefully into account. Many bridges have been destroyed owing to changed conditions of the water run off in streams and rivers, due to the denuding of our forests and the clearing up of water-sheds.

Engineers as Public Speakers

THERE is no oratory so potent as sincerity, no rhetoric so effective as simplicity, and no logic so persuading as marshalled facts, says Engineering and Contracting in a well-considered editorial discussion of the above topic. The fundamentals of the art of public speaking, says our contemporary, are possessed by most engineers when they speak on engineering subjects. But practice must be had in this art as in every other, if greatest effectiveness is to be attained. We urge all civil engineers to join local engineering clubs and societies and to practice discussing engineering subjects at the formal meetings of such organizations. Why, indeed, may not the old debating society methods be adopted? It is said that many of the orators of the West, of which Bryan is perhaps the most illustrious example, learned their art in country town debating societies. While engineers will not seek to emulate some of the methods of the orators thus trained, is it not likely that engineers could greatly profit by adopting the underlying plan of the old-time debating society?

Incidentally there might spring from such debates a public interest in engineers not otherwise obtainable.

Suppose, for example, a question had arisen as to the desirability of purchasing a water works owned by a company. Suppose the local engineers' club were to announce a debate on the question, naming, say three engineers on each side. Is it not probable that the debate would be well attended by the public? Is it not certain that the local press would report the debate fully?

Engineers are now prone to "let George do it"—George being the lawyer—whenever there is to be speaking on public matters. It is amusing, in spite of the serious side, to an engineer, to listen to the ordinary lawyer or politician address an audience on any topic of an engineering nature—roads, for example. Who of us has not smiled, and yet sat ill at ease, while such a man tried to make a Patrick Henry oration on "good roads"? Yet, if we engineers will not speak to the public, perhaps it is well that some one should speak, even if the speech be ridiculous in connection and ornate in delivery.

Every engineering college should teach public speaking and should give its students much practice in the art. There can be no serious discord on this point. But we who have graduated without such

training, have had to teach ourselves, as best we could, how to talk in public. This self-teaching, after all, would not be so difficult if only it were possible to get sufficient practice. And it is with the idea of securing practice that we have suggested the debating society.

Larger debating clubs of engineers might profitably employ an instructor in elocution. But even if no outside instructor were hired, one or more members of the club should "coach" the speakers. Few men are good originators but few are poor critics.

As a youth the writer was a member of a debating society that solved all, or nearly all, the political problems that had baffled American, and indeed the world's statesmen. It is true that even yet some of the most noteworthy decisions of that society have not been written into statutes. But it is equally true that several members of that society reached high

political positions, largely by the "political pull" of a rugged "nerve" and strong vocal cords, aided by a bit more than the average of intellectual ability.

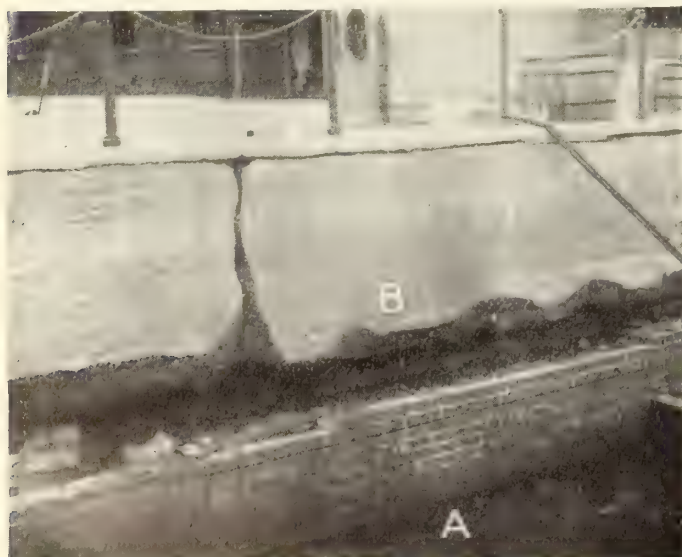
Politics, however, is not the aim of many engineers, when politics means divorce from engineering. But the majority of civil engineers are in politics to the extent that they are doing public work. Even railways and other public service companies are fast becoming parts of the great social machine that is under the control of public servants. We are entering a new engineering era, and with the change there will come increasingly greater opportunities for the civil engineer in public service. Indeed, may we not witness—sooner than perhaps seems now credible—the election of many engineers as chief magistrates of cities and states, with ultimately a return to first principles, namely, the election of a civil engineer to the presidency of the United States?

The Protection of Concrete in Sea-Water Between High and Low Tide

By William B. MacKenzie, C.E., Moncton, N.B.

THE accompanying view shows a typical example of the deterioration of concrete in sea-water when exposed in the intertidal space to wetting and drying, freezing and thawing in northern latitudes. The rate of destruction between A and B in the photograph was $\frac{1}{2}$ to $\frac{3}{4}$ of an inch a year after about the third year. This wall has been twice repaired. The first time the repairs were made with vitrified bricks, but they were not carried up high enough and the waves reached above them. It was repaired further in 1911 by adding four tiers of small concrete blocks, of cement one, sand two, set in air. The vitrified bricks have remained in perfect condition. The concrete blocks set in 1911 are already showing signs of damage. The quality of the concrete below low-water and above high-water is first-class. I have observed that where sea-water is mixed with fresh water, to the extent of, say, fifty per cent.,

*Right of Way and Lease Agent Intercolonial Railway of Canada.



An example of the destructive effect of sea-water upon concrete in the intertidal space.

as at the mouths of rivers, or in arms of the sea projecting far inland, the rate of destruction is considerably greater than in sea-water alone.

The system of protection patented by the writer and described herein consists of a combination of vitrified salt-glazed hollow clay tile blocks (built in with the concrete structure) which form an outer shell to protect the inner concrete structure from contact with the sea-water or the atmosphere, and which completely protect it from frost and wave action. The blocks are pressed through a die, in a manner similar to the ordinary building blocks, but they are of greater thickness. Further, they are finished with large openings in the sides and ends, so that the wet concrete runs into the blocks by gravity, as they are built up into a wall slightly higher than the mass of concrete which they enclose. Usually the block wall forms the mold for the concrete body, iron tie-rods being used to prevent the block wall from spreading while the concrete is wet. When completed, the blocks become an integral part of the structure and the whole presents the appearance of a tile block construction, as shown in figures 7, 8 and 9.

Fig. 1 is a top plan of two tile blocks, placed end to end and kept in line by grooves and tongues at D. B B are holes in the ends and sides of the blocks to allow the wet concrete to flow into the blocks by gravity, concrete can also be put in directly from the top. C C are the tie-rods which prevent the blocks from spreading by the pressure of the wet concrete. The rear and end walls, and the continuous concrete connections in both directions, lock the blocks into the concrete body so that there is no possibility of separation. It is known that cement adheres very strongly to a tile surface, no matter how smooth it may be.

Figures 2, 3, 4, 5 and 6 show the details of the blocks and also the closing pieces which are to be used when walls are built with battered ends.

The blocks can be made of any desired dimensions, but they are usually eight inches by eight inches by sixteen inches. The walls of the blocks can be made of any desired thickness, but two inches, for the front

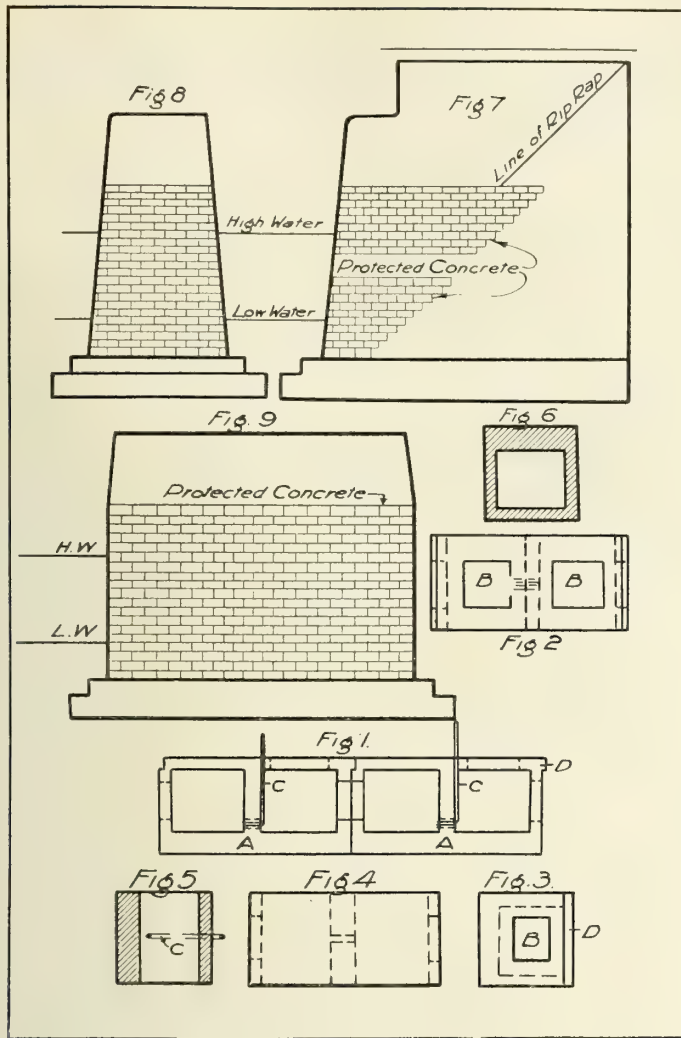


Fig. 1-9. Protection of concrete in sea-water.

and middle wall and one inch for the back and end wall is sufficient.

A thoroughly vitrified and salt-glazed block which has been subjected to a furnace heat of 2,400 degrees Fahr. is as impervious to water as a china tea-cup and is not affected by sea-water, alkali, acids or gases. It cannot possibly be affected by frost or alternate wetting or drying.

The 1907 Committee Report of The American Bridge and Building Association, as a result of careful examination of many concrete structures in sea-water, draws attention to the unsuitability of concrete for use between high and low tide. Many other authorities have reported numerous cases of damage in similar situations and leading construction engineers are now either using granite or covering the concrete with wood.

Many of the concrete bridge piers on the railways and highways along the Bay of Fundy shores are encased entirely in wood, while some of the more important highway bridge piers over large rivers in fresh water are being built either wholly or partially of granite, much of it being transported long distances, although sandstone quarries exist in the vicinity. A large concrete pile wharf for ocean steamers now under construction has a part of the concrete piles covered with wood. On the Atlantic Coast, a large ocean terminal, to cost many millions, is designed with granite facing. Even on the Pacific Coast, where very

extensive ocean terminals are designed, concrete is barred in the intertidal space.

The cost of the vitrified tile blocks is a mere fraction of the cost of any concrete structure. For the exposed face it is very much cheaper than granite. No one can successfully dispute the indestructibility of vitrified tile.

Scientific Management

IN publishing elsewhere in this issue an abstract of a lecture on Scientific Management delivered at Columbia University, we believe that we are providing our readers with several points worth turning over, but we cannot fail to recall the editorial criticism of the subject launched some two years ago by our contemporary, *The Engineer*, of London, England. The following is an extract from the editorial in question:

"Anyone who studied for a few months the engineering papers of America would come to the conclusion that the worst managed shops in the world were those of the United States. Paper after paper contains articles on shop management, on scientific management, on the Taylor System, the Gant system, bonus, premium and piecework systems, on the use of card indexes, on route cards, on shop costing, and so on, and so on, ad lib. The continual striving for something different implies discontent with existing things, and we are thus led to the conclusion that the Americans themselves deem their systems bad and unsatisfactory. A man in perfect health takes no interest in his internal mechanism; he is not continually overhauling it, patching, mending and altering it; he is so well satisfied with it that he forgets its very existence, and it is only when he becomes conscious of it that he knows he is unwell. The American works manager appears to be continually conscious of his organization. There seems to him always to be something wrong with it, and he is for ever trying new experiments on it."

Another Problem for the Water Analyst

THE responsibilities of the waterworks field are rendered greater by the fact established by recent official investigations in the United States that cancer, one of the most malignant and most dread diseases, is water-borne. Of 19 trout hatcheries examined, evidences of cancer were found in all. That only trout grown artificially have the disease and that cancer is regarded as non-contagious, are facts which only provide food for deeper reflection. The *Engineering Record* discusses the matter editorially in part as follows:

"Transmitting cancer by means of water is not a new theory, but what are the details of the transmission? Is there an intermediary host—bacteria which an infinitesimal cancer bacterium infects? Perhaps the chemical residuums of life and the very care which domestication involves tend to reduce, as in humans, that power of producing sufficient opsonin or resisting force to the attacks of the numerous disease germs to which the human economy is continually subjected. At any rate, the subject is of such vital interest that analysts will no doubt be glad to co-operate with those already in the field searching for preventive means of transmitting cancer. Possibly some one has already tried filtering and chlorinating the water, carrying cancer to the last pond in the series noted. Should this or any other chemical water treatment prove beneficial the fact would be of tremendous import to the waterworks field."

Cost-Accounting Systems for Engineering Contractors

OWING to the diverse conditions under which the many branches of engineering contractors have to work, a system of cost-keeping that will be applicable to all contracts must be expansible and simple in its detail. An attempt to explain such a system is made by a special committee of the American Society of Engineering Contractors in a recent report.

Many systems have been under consideration, but a large number of them are more suitable for a factory than for an engineering contractor in actual contract work in the field. Some of them are so intricate and involved that the very cost of maintaining them on the job would be a considerable item to be charged against the profits and in many cases would be prohibitive.

An elaborate system of cost keeping can be utilized in a factory where there is usually a fair number of skilled workmen among the employees, and a clerical force among whom the work of collecting and tabulating the records can be apportioned; in fact one is now likely to find in a factory, men who will take pleasure in keeping up a record card. While in the field the good foreman is usually more adept with the pick than with the pencil and he sees that the work proceeds, but neglects the record.

A system that will meet with the demands of a small contractor must be one that can be applied by the man himself—his superintendent or timekeeper, and usually the man who is most adapted to look after the cost keeping is the timekeeper, who should be thoroughly capable and trustworthy; in fact, the proper keeping of the field notes depends largely on the personal ability of the timekeeper to consign to each employee his place on the daily record.

An important feature to be carefully provided for is the proper identification of every individual workman by some distinctive means—usually a number—and a brass check or badge is assigned to him with his number stamped upon it. Where a large number of men are employed, a badge that can be pinned on to the cap or the outside garment is very desirable, but in most instances the brass check is the favorite method employed.

His check is given to the employee in the morning and returned by him to the office at the end of his shift. This makes a check upon his presence on the job at those two times, and his attendance at the work is

verified by the timekeeper at regular intervals throughout the day.

The check should be kept on board panels and should be arranged in numerical order. The panels can be readily made to fold together and be locked up, thus keeping the records of each shift intact and separate from the other shifts.

The checks should be assigned to the workmen in groups somewhat along these lines, which of course will vary with every contract:

Office force and foreman	...	No.	1 to 20
Carpenters and helpers	...	No.	21 to 50
Machinists and helpers	...	No.	51 to 80
Hoisting Engineers	...	No.	81 to 100
Laborers	...	No.	201 to 400

In this way each workman can be immediately placed in his proper group as soon as his number is known.

When a number has been assigned to the workman a white cardboard check should be hung on his hook, which should be made out as per sketch:

JOHN DOE
217 Blank St.
Toronto
Laborer 20c.
Started Dec. 31st.
Disct.

This gives the timekeeper a record that is often of value in case of accident. On many jobs workmen are only known by a number and in case of a fatal accident it is almost impossible to properly identify him. On the reverse of the cardboard check the age and name of nearest relation can be placed, and this card can be saved even though the man has been discharged, until the end of the job.

Each contractor should decide for himself to what degree of refinement he wants to keep his records, and should outline certain heads which can be further subdivided later on. For instance, the item of plant, and its removal from the contractor's yard to the job and its return to the yard again might be put under one head (Plant) and assigned a number 1. Many contractors would be satisfied to keep that expense by itself

DISTRIBUTION OF CARDS

JOB

DATE	1—PLANT		2—TEMP. BLDGS.		3—HAULINGS		4—EXCAV. EARTH		5—EXCAV. ROCK	
	Labor	Materials	Labor	Materials	Labor	Materials	Labor	Material	Labor	Materials
1914										
Jan. 1										
2										
3										
4										

The labor amounts are daily recorded in the book and explanations for materials are similarly recorded on the day of payment. Each column is added daily, weekly or monthly as suits the convenience, but by keeping the additions made up from day to day it is possible for the contractor to know exactly where he stands or any one on all items.

while others would want it sub-divided into, say, loading at yard, hauling to railroad and loading on cars, freight, unloading at job, and in that case would give each sub-head a number, 1a, 1b, 1c, etc. Plant erection and dismantling are often placed under No. 1, while others might prefer to have a separate item.

Temporary Buildings.
 Unloading and hauling of Materials.
 Excavation of Rock.
 Excavation of Earth.
 Building forms for Concrete.
 Erecting and dismantling forms for Concrete.
 Mixing and Placing Concrete.
 Miscellaneous Work.

The above items may be used as a start for a system of cost keeping. The daily time distribution sheet used by the timekeeper would be lined out as follows:

DAILY TIME REPORT FOR.....

No.	Rate.	Time.	Amount.
-----	-------	-------	---------

.....			
.....			
.....			

The workman's number in column No. 1			
" " rate " " " 2			
" " time " " " 3			
" " amount due " " " 4			

In the other columns the head spaces are left blank so that any number or item can be written in by the timekeeper, it being preferable to use a number, then the record is more private than if the name of the item is used. Thus: 1 at the head of the column might with one contractor mean plant while with another it might be assigned to excavators. The workman's time is checked off under the various headings or items at which he is employed during the day. These hours must agree with his full day's record and the sum of the several columns for all the workmen must balance the time on the amount column each day.

The time keeper's record is handed in daily and recorded in the office book, which is columned out so as to provide a column for each item, and each item column is divided into two parts, one for labor and one for material, as per sketch.

Instead of completely tearing up the old macadam roads to replace them with more modern construction where motor traffic has made their maintenance prohibitive in cost, the authorities of Allegheny County, Pennsylvania, are preserving these old road surfaces by using them as a base for new concrete or brick roads. Mr. J. S. Gillespie, County Road Commissioner, in addressing the American Road Congress at Detroit, stated that for brick roads the macadam is first scarified and formed to a true cross-section, concrete curbs are built, the sand cushion is placed, and the brick are laid, after which the surface is grouted with a mixture of equal parts of sand and cement. In the other class of construction, bituminous concrete is laid directly upon the scarified and levelled surface, and both finished surfaces are rolled. The method is said to be economical and satisfactory.

Fairness in Contracts

WE recently expressed an opinion of the unfairness to contractors of too many municipal contracts, and a paving contract which we have just examined serves as a further illustration of the point; also of the use of irrational units, says The Municipal Journal.

This contract in the first place requires that proposals be made on the basis of the square yard of finished work, including not only grading, ballasting and paving, but also special work under and around the ties of railroad tracks in connection with the foundation, the curb, the removal of "all obstructions such as trees, stones, blocks, etc." The only way in which the contractor could bid on work of this kind by the square yard is to estimate first the entire cost of the work and then divide this by the total area of pavement proper, running the risk of not only erroneous calculations but also of false assumptions or guesses as to the amount of trees, stones, etc., to be removed and the relative proportion of curb and special track foundation work to pavement proper, with the disadvantage that an error either way is against him, in that it either causes him to bid too low and thus lose money or to bid too high and probably fail to get the contract. The uncertainty is increased by the fact that the street railroad is to be given the opportunity of paving in the track area if it desires, but otherwise this work shall be done by the contractor.

Care is taken to specify that the city shall not be liable in any manner to the contractor for any damage to him or loss due to any rock, water, sand, or any other unforeseen construction or material which he may come across in the work. Also that the city is not to be liable for any extras of any kind or nature unless these are ordered in writing. The city reserves the right to increase or decrease any part of the work indefinitely; also places on the contractor any loss which he may sustain owing to delay forced upon him by any cause whatsoever, not even allowing an extension of the time of his contract unless he immediately give notice to the city in writing of the cause of the delay. Finally, payment for the contract is to be made in special assessment certificates which the contractor is to receive in payment for the contract at their face value. Even if there were no other loss to the contractor, he is required to leave with the city a bond in the sum of forty per cent. of the contract price, the interest on which sum he loses directly or indirectly.

With all these risks forced upon the contractor apparently the only opportunity left open for a loss to the city is by the failure of the pavement, the contractor not being under a maintenance bond. The specifications are good, and if the work is in charge of an engineer and inspector who know their business the city will probably obtain a good job. If the work moves along without any unforeseen difficulties, if the quantities constructed are approximately those indicated on the plans, and if the engineer and inspector are reasonable and men of experience and common sense, and if the contractor has figured correctly and allowed for a fair profit in making a bid, then the chances are that both he and the city will be satisfied with their contract. But, if any of the conditions above named should develop otherwise during the construction, then the contractor is very apt to be a loser, and the only loser—unless he can take it out of the city without their knowledge; and contractors are only human—most of them very much so.

Perco-Filters for Sewage — Diagram for Ascertaining their Dimensions

By R. O. Wynne-Roberts, Consulting Engineer, Regina, and L. W. Wynne-Roberts, B. Sc. (Hons. Eng., London), Regina

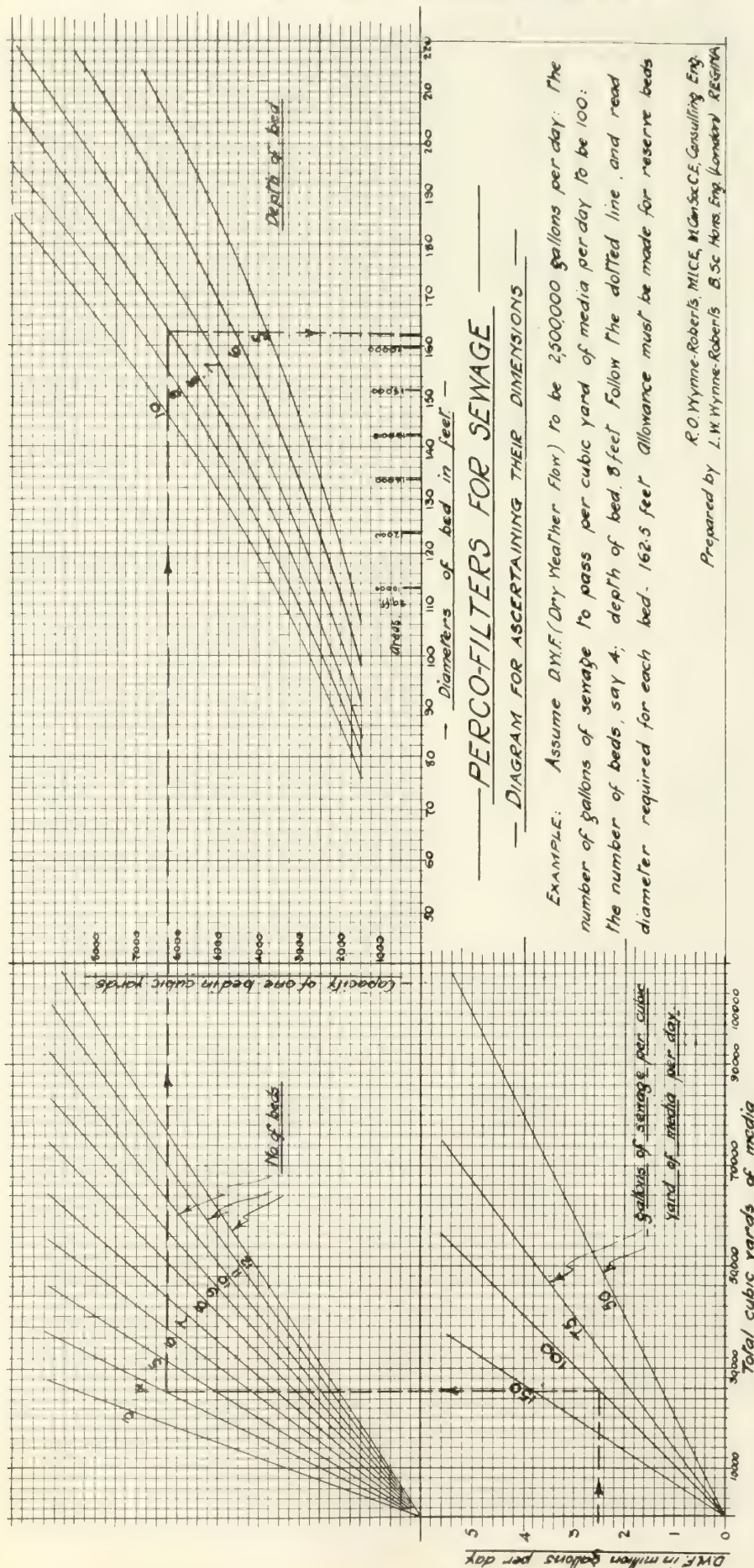
THE designing of sewage filters may appear a simple matter, but it often occurs that there are certain conditions which govern their arrangement, dimensions, etc. For instance, in one district, the fall may be very slight, and deep filters are not possible without pumping operations; in another district the fall may be great, and reasonably deep filters will economise the area of land required. Between these extremes there are numerous conditions to be considered.

In this article it is not proposed to discuss the advantages and disadvantages of deep and shallow filters; these may be dealt with in a future contribution. There is, nevertheless, a minimum and a maximum depth of filters to obtain the most efficient results, both financially and bacteriologically, and the engineer will be well advised, when designing sewage filters, to fully consider this matter.

The question is often asked what size filters are required to perform a certain work. Before an answer can be made, due consideration must be given to, and much will depend upon, the strength of the sewage, the efficiency of the settling tank, and the size and material of the filtering media.

The diagram accompanying this short article has been designed to meet practically every condition, and for all dry weather flow up to six million gallons a day. The capacity of any filter per cubic yard of filtering media may be anything from, say, 50 to 150 gallons a day; there may be any number of filter beds, say, from 3 to 12, and their depth may range from 5 to 10 feet.

When the engineer has selected any one of these factors, he has simply to trace a line from the dry weather flow column clockwise, as described in the diagram and the final figure will be the diameter of a circular percolating filter. The engineer may reverse the procedure, however, and arrive at the daily dry weather flow. The diagram is simple and self-explanatory.



Lessons from the Sewage-Treatment Plant of Columbus, Ohio

By Rudolph Hering*

THE receipt of the annual report of the Sewage Disposal Division of the City of Columbus, Ohio, for 1913, by C. B. Hoover, suggests a few remarks, in view of the facts that the Columbus sewage disposal plant is the first large plant of its kind in this country and that the experience gained by it is, therefore, especially valuable, and most strongly emphasizes the directions in which progress is being made.

When the Columbus problem was studied in 1901, I recommended septic tanks followed by intermittent filters, because this treatment, among the several treatments then known, was the best. Caution, however, was also recommended and the advice given a year or two later that certain experimental investigations be made, in view of the economical phases of the sprinkling method of treating liquid sewage, then being developed in England. It was especially necessary to make such investigations on account of the much colder winters in our western climate. The results caused the local authorities to adopt septic tanks and sprinkling filters, which later were detailed and built.

Mr. Hoover in his last report gives a very good summary of the present condition and states his conclusions for future work.

The operation of the filters has extended over a number of years. Sprinkling filters have proved to be an economical success even in severe winter weather. At the present time it is reported that the river is seriously polluted with raw sewage and trade waste, extending for over 15 miles. Foul odors, gasification and floating sludge are present at times within a zone, the boundaries of which are determined by the dilution, the oxygen in the river water and the temperature. In consequence of this, Mr. Hoover recommends "the installation of additional and improved treatment facilities." A number of lessons may be learned from this case.

(a) With a seemingly recommendable disposition, both communities and their engineers are too often inclined to curtail the cost by planning works, either with too small a margin for the natural growth of a city, or with a feeling that in the near future new solutions would require extensive alterations in any works at once to be built.

The first reason for keeping expense down should be strongly opposed by engineers because history pretty consistently shows that unless a city outlines and persists in following a definite plan of extending its public works, they may soon become insufficient, their expenses increased and the former troubles repeated, sometimes with unfair reflections upon the engineers.

The second reason, regarding new solutions in embryo, is more difficult to handle. A city may be compelled to seek some relief at once and cannot wait any longer. The engineer must recommend a definite plan. If he has good cause to believe in the early birth of a better plan, he stands before two alternatives. Either he should at once report his belief and the

grounds for it to his client, who then assumes the responsibility of action, or in the absence of such belief at the time when his recommendations are adopted, he should report any new discoveries or developments to his former clients, as soon as he is fully convinced that the art has materially improved in the designs or constructions which he had previously recommended. If engineers act conscientiously and courageously under such circumstances, respect for and confidence in the members of our profession would correspondingly rise. The responsibility for further action then again rests with the clients and not with the engineer.

(b) While engineers a few years ago considered the septic tank a "necessary evil," they now generally consider it an unnecessary evil, to be replaced by some method of inoffensive sewage disposal as soon as practicable. Where no septic or ordinary settling tanks exist, the installation of the inoffensive but deeper two-storey tanks is generally easy. But where large areas are already covered by the shallower septic tanks, as in Columbus and many other cities, the solution is more difficult. This at present is an instance of an expected early birth of a plan to supplement such single and shallow tanks which will secure inoffensive decomposition and sludge.

(c) The building of final settling basins for the Columbus filter effluent did not then seem necessary to me, because the septic sludge was intended to be, and until recently was, flushed at flood times into the same river which received the filtered effluent at all times. I did not recommend such final basins for Atlanta because the effluent from the filters carries less suspended matter than the river water which was to receive it. Mr. Hoover reports the improvement of the sprinkler effluent as affected by the final settling tanks to be only eight per cent. with respect to its stability value, which is the value to be considered for a discharge into river water not soon used for a potable supply.

Unless the effluent discharges into a stream always having clear water, I believe that money for such final settling basins can be better spent by still further oxidizing the effluent water than is usual before it leaves the filters. Nonputrescent suspended matter from a good sewage filter when entering a brook or river is no more objectionable in quality than the solid matter which is usually washed into the same by a rain storm from agricultural lands.

(d) Mr. Hoover further says, that where gasification was noted in the river, sludge deposits were found, and also says that odors were never detected in the Scioto River at such points where there was any residual dissolved oxygen, and even the entire absence of oxygen was not always accompanied by odors.

The sewage-treatment works, according to Mr. Hoover, were in service 61 per cent. of the total time and 97 per cent. of the time from May 17 to December 31. Mr. Hoover, therefore, very properly urges additional installations.

Sludge deposits in rivers cause the rapid abstraction of dissolved oxygen, even to its entire disappearance, with the subsequent condition of putrescence

* Of Hering & Gregory, Consulting Engineers, New York City, writing in the Engineering News.

and of nuisance caused by the generation of sulphuretted hydrogen. If there were any need for further evidence, which in my opinion there is not, the Scioto River at Columbus again clearly indicates the objectionable result of sludge deposits. We can improve many of our rivers at and below cities discharging raw sewage into them, simply by removing the sludge deposits and getting clean bottoms, both near the shores and in the docks, as well as in the beds. I believe that in time river cleaning will be considered as desirable as street cleaning.

Columbus' experience once more verifies the opin-

ion of many, that offensive odors do not arise from sewage-polluted rivers, if their water still contains residual oxygen, and that it is unnecessary to spend large sums of money to oxidize liquid sewage on land wherever it can be oxidized in running water in such manner that at no time and at no points the dissolved oxygen in the water will be depleted. The latter condition positively secures the absence of a nuisance, as evidenced not only at Columbus but at many other cities. The question of water-supply, of bathing, of fish life and of agriculture, where they arise, must be answered on a different basis from that of a nuisance.

Contractors' Camp for Workmen on the New Quebec Bridge

THE camp of the St. Lawrence Bridge Company, Limited, at Quebec Bridge, described by L. G. Jost in Engineering News, is situated near the north abutment of the bridge, on a natural plateau which slopes gradually toward the east. It is protected on the north by a wooded hill and on the east and south by a low ridge of rock. As the bridge site is about half a mile from the main road, three miles from a street-car line, and eight miles from Quebec, and as the housing facilities in the neighborhood were inadequate, it was necessary to build prac-

basins and six shower baths. At the rear is the boiler room with a low-pressure boiler from which housed pipes are run for heating the dining hall and kitchen.

The dining hall is a bright room 47 x 58 ft. in plan; the roof has a slope of 1 on 12, and is carried on six 15-in. 42-lb. I-beams resting on 8 x 8-in. posts on sides and center. It has a seating capacity for about 150 men.

The kitchen building is two storeys high, the upper being used as office and bedroom for the camp steward and quarters for the culinary staff. One end of the ground floor is a storehouse for dry groceries, while the other end is a cold storage room (heretofore cooled by ice, but now by an ammonia plant).

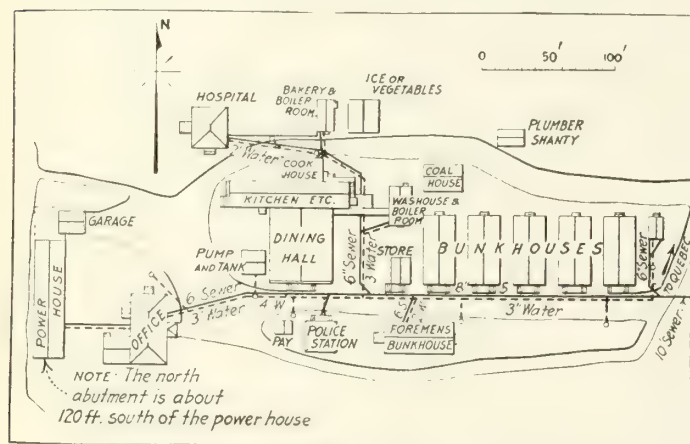
The cooking is done in an 18 x 30-ft. addition at the rear. The steam cooking utensils are operated by a high-pressure boiler in a house at the rear. This boiler also supplies heat for the hospital. The latter is a 24 x 28-ft. building and contains an office and bedroom for the resident physician, and one ward with bathroom, etc. It is intended only to administer first-aid treatment. All serious cases will be removed as soon as possible to the Quebec hospital.

The office building is a two-storey structure 28 x 53 ft., with a one-storey wing 20 x 20 ft. used as a draughting room. The interior of the building is sheathed. On the second floor there are seven bedrooms, a bathroom and a living room; in a small concrete cellar, there is a low-pressure steam boiler.

Other buildings not mentioned are a garage, a small pay shack, a general store, coal house, plumber's shanty, stable, police station, and bungalow for the superintendent and the engineer in charge of construction work.

Water is supplied to the camp by an artesian well. The water is pumped to a 10,000-gal. tank on a 40-ft. tower. Five 3-in. fire hydrants take care of the entire camp. At each hydrant is a small hose house containing two 50-ft. lengths of fire hose. The vitrified sewer mains range from 6 to 10 in. in diameter, and with the water line are buried about 2 ft. deep and follow the natural slope of the ground, which gives a gradient of from 3.5 to 0.5 ft. per 100. At the outlet the sewage runs into a 10 x 10-in. wooden chute and is carried over a bluff to a point below high-water level, some thousand feet downstream from the bridge.

The camp is lighted electrically by current transmitted from Quebec. Should this supply fail, the company's power house is able to carry the lighting load.



Lay-out of St. Lawrence Bridge Company's Camp at Quebec Bridge

tically a complete village. This was commenced in August, 1912, on land leased from the National Transcontinental Railway.

The plan gives a general layout of the camp, including the water-supply and sewerage systems.

There are five bunk houses, each 24 x 53 ft. in plan and comprising eight 10 x 10-ft. bedrooms and a 12 x 24-ft. sitting room in front. The inside partitions are of single sheathing 8 ft. high; each room contains two two-tier bunks. A large stove in the living room with a pipe running the full length of the building provides heat in winter. The bunk house of the foreman is similar but has nine smaller sleeping rooms and a bathroom.

The common toilet is at the east end of the camp, and is 11 x 18 ft. in plan with sloping concrete floor which may be hosed out. It contains two range closets; and the automatic flush tanks are kept warm in winter by coils from a jacket heater. The 17 x 30-ft. wash-house building contains 18 porcelain wash



New Deck Girder Bridge of Canadian Northern Railway over North Thompson River, Kamloops, B. C. (Bridge 1209 ft. long. Lift span 93 ft. long, with 55 height of lift.)

Deck-Girder Bridge with Girder Lift Span, Kamloops, B.C., over North Thompson River

A RAILWAY bridge of unusual proportions at Kamloops, B.C., carrying the Canadian Northern Railway over the North Thompson River, is described by Engineering News. The structure is a deck-girder bridge, 1,209 ft. long, and has a deck-girder lift span 93 ft. long. There are 12 fixed spans, also of 93-ft. length. Approaches at both ends of the bridge, of timber trestle construction, total about 1,100 ft. The bridge was designed by Messrs. Waddell & Harrington, of Kansas City, Mo.; the lift span is built with the arrangement and details used by them in their various lift bridges built in recent years. In this structure the lift span weighs 118 tons, and is fully counterweight. The sixteen $1\frac{1}{4}$ -in. lifting cables are equalized in the attachment to the span. Centering casting provide for keeping the span in proper alignment as it comes down to bearing, and also take the longitudinal braking thrust. The lift of the span is 53 ft., giving a 55-ft. clearance above high water. The motor is capable of raising the span in 100 seconds. The lifting power is a gasoline engine, which, with all the machinery except the operator's levers, is located below the deck, at the middle. Limit switches coming into operation near the ends of travel of the span control the igniter circuit of the engine.

Breakwater Construction

IN a recent report the Harbour Improvements Committee of The American Society of Engineering Contractors recommend that in constructing rubble mound breakwaters the stone used should be paid for, preferably by the short ton of 2,000 pounds, as this is usually more satisfactory for all parties concerned than when the cuft or cuyd is used. Especially is this true where the stone is hauled direct from the quarries on scows as gauges can be placed in the scows and the load displacement quickly and accurately determined. When concrete superstructures are built, the superstructure, of course, should be paid for by the cubic yard.

As winds and rough seas are prominent factors to be considered in breakwater construction, the time for completion of a contract should be extended for a rea-

sonable length of time before applying a penalty in cases where work has not been completed in the prescribed time, owing to unfavorable weather conditions alone, and not delayed for other causes that could have been avoided. The bonus and penalty plan, while a good thing in most kinds of construction work, cannot always be satisfactorily used in breakwater and pier construction.

While it is considered to withhold a portion of the money—usually 10 per cent.—due for work done to insure the completion of the contract, it is also considered advisable to accept and pay in full for the portion of a breakwater that has been satisfactorily completed, provided a considerable portion of the remainder of the work is at least half completed. The portion to be accepted and paid for in full when completed should not be less than 25 per cent. of the whole.

This acceptance and paying in full for parts of contract work that has been completed, should apply to the construction of piers and docks as well as breakwaters.

Ice Jam on Fraser River Wrecks Bridge Falsework

Sweeping down the Fraser River in British Columbia last month, an ice jam carried away 250 feet of falsework which had been erected for the Kettle Valley Railroad bridge at Hope. Work on the substructure was begun about two months ago and the falsework had been extended 750 ft. from the south shore. Above Hope the river had been tightly packed with icefloes which had drifted down from the upper reaches of the Fraser, and when the temperature dropped suddenly the whole mass commenced to move. The contractors had foreseen this occurrence and one of the costly open caissons which was ready for launching was saved by being secured behind a breakwater. All the men on the work were warned in time to escape, but part of the falsework went out and in so doing precipitated into the river two hoisting engines, a derrick and a concrete mixer. After some difficulty all this equipment was salvaged and is reported not seriously damaged. The contractors, Messrs. Armstrong & Morrison, of Vancouver, B.C., still hope to complete the substructure before high water, which is due about May 1. The bridge is to be a double-deck structure supported on four 238-ft. spans.

Measurement of Gravel in Piles

By Oliver Clark

IN purchasing, selling and excavating gravel, there seems to be a growing tendency among contractors, public officials and others to have the gravel measured in the pile as soon as convenient after it has been excavated. The immediate measurement enables the parties to know the approximate quantity so that they can arrive at an immediate settlement, and the gravel can be hauled away without the trouble of keeping account of the number of loads.

The greater number of these piles are taken from wet pits and located on comparatively level ground. The usual method of excavating is by means of an endless chain or dredge, and the manner of excavating has much to do with the shape of the pile. The more regular the pile, the more easy it is to measure it accurately.

Probably no two engineers use exactly the same method in measuring gravel piles, nor are any two piles exactly the same shape. Before attempting to measure a pile I view it carefully and determine what mathematical figure it most nearly approaches or can be made to approach by cutting the same into sections. Where the sides of the pile have a very steep incline, so that the taking of horizontal and vertical measurements would be difficult, I usually take the angle of inclination of the sides at the base and the distance up the incline, from which the horizontal and vertical distances can be computed trigonometrically.

Some piles will most nearly approach a cone, usually with an elliptical base, the area of which can be obtained by getting the major and minor axes. The quantity can be calculated by cutting the pile into quarters, taking the angle of inclination and the slant height from all four sides, and then computing trigonometrically the horizontal and vertical distances. The sums of the horizontal distances obtained from opposite sides will give each axis. The average of all four vertical heights will give the average height of the cone, at the same time taking into consideration the difference that may be in the level of the ground at all four points of the base.

If the pile should take the shape of a frustum of a cone, set a stake in the middle of the top, so that the highest point will be the vertex, and calculate as before, taking the extended volume from the result. If the pile has curved sides from top to bottom, it will be necessary to cut it into sections (parallel to the average level of the base) and calculate each section thus obtained as a separate frustum of a cone or a prismoid, using the prismoidal formula.

The most general form of pile is oblong with steep sides curved from top to bottom, coming so nearly to an apex as to be easily extended, and having elliptical ends. My usual method in measuring such a pile is to first cut off each end by a vertical plane at right angles to the main axis of the pile, then divide the remaining middle portion into three or some multiple of three sections (depending on the regularity of the pile) by vertical planes at right angles to the main axis of the pile, so that when the area of each cross-section is obtained, the entire middle portion can be calculated as one or more prismoids.

To get the area of each cross-section, take the angle of inclination and the distance up the incline for each course in going up the pile from the base to the top (the end of each course being so taken as to correspond to the greatest break in the slope of the side of

the pile), and from the data thus obtained the horizontal and vertical distances can be computed trigonometrically and the sections divided into triangles and trapezoids and the area obtained.

The end sections can be calculated as half the frustum of a cone with an elliptical base, one axis of which will be the bottom width of the end cross-section and the half of the other axis will be the horizontal distance from the end cross-section to the extreme end of the pile at the base, running in the same direction as the main axis. The method of obtaining the cubical contents of these end half cones will be the same as in the first case described.

If the pile be low and spread out over considerable ground so that the horizontal distances can be easily measured, it may be cut vertically into squares, say 10 ft. each way if very irregular or 20 ft. if regular. The elevation of each corner of the squares, as well as the elevation of the ground at the base should be taken by a levelling instrument. The average elevation of the ground at the base should be obtained by taking elevations at equal distances around the base in such a manner as to average the high and low points as nearly as possible. The average level of the base thus obtained, taken from the average level of all four corners of each square, will give the vertical height of the prismoid whose end is that particular square. From these data the cubical contents of each prismoid and the cubical contents of the entire pile can be computed.—Engineering News.

Weight of Crowds on Bridges and Grandstands

The Impossibility of Customary Load Requirements

THE question of the weight of a crowd on bridges and other structures has been the subject of numerous controversies, and the requirements made by the Local Government Board and various public bodies in this country are sufficient to show that available data have not been so fully appreciated as could be desired.

In an article contributed by Dr. Ing. Bohny, to *Centralblatt der Bauverwaltung*, it is stated that an almost universal practice is to take the weight of a crowd at 420 kilogrammes per square metre (92.16 lb. per sq. ft.) on the roadway of a bridge, and at 550 kilogrammes per square metre (112.64 lb. per sq. ft.) on the footpaths, the author adding that "technical literature is mute as to the origin of these figures."

It may be presumed that they embody the results of experiments made in closed chambers with a compact and immobile crowd, and which are quite inapplicable to bridges in actual use. As values for the weight of crowds covering large areas are lacking, it is interesting to study the following carefully determined recent figures given by Dr. Bohny.

Taking the average weight of a person at 60 kilogrammes (132.3 lb.) it is evident that $7\frac{1}{2}$ persons per square metre would be required to realise the load of 450 kilogrammes. In British units this involves nearly $1\frac{1}{2}$ persons on every square foot, a moment's consideration sufficing to demonstrate the absolute impossibility of squeezing people so tightly together, save by hydraulic pressure or some process analogous to that employed in the packing of sardines.

In order to arrive at anything like a true idea of the compactness of a crowd, it is necessary to count the number of persons occupying an area of known extent. Mr. Kunz, formerly chief engineer to the Penn-

sylvania Steel Company, and builder of the Blackwell Island Bridge, New York, has given the results of two investigations of this character, the weight per person being taken at 132 lb.

The first determination was made at Coney Island, on a bridge where a dense crowd of people had assembled to watch an exciting spectacle on the water below. Having counted the number of persons, and measured the space occupied by them, Mr. Kunz found the load to be less than $13\frac{1}{2}$ lb. per square foot, or from one-eighth to one-thirteenth of the loads frequently demanded by the Local Government Board and various authorities in this country.

The second observation took place on the upper deck of one of the large ferry steamers plying in New York harbour, these vessels, like street cars, suburban railways, and all other means of transport in New York, being customarily packed to overflowing. Nevertheless, Mr. Kunz found the average load to be only 26 lb. per square foot.

These practical figures differ materially from the theoretical values cited. They are sufficient to show that crowds representing an average load of 30 lb. per square foot must be of very exceptional occurrence on bridges, and to prove the utterly unwarrantable nature of specifications insisting upon such unattainable values as 1 cwt. or $1\frac{1}{2}$ cwt. per square foot for the weight of a crowd on bridges.—Ferro-Concrete.

Test of Flat-Slab Floor

By W. A. Slater, Engineering Experiment Station, University of Illinois

THE first floor above the basement in the new factory of the Shredded Wheat Company of Niagara Falls, N.Y., was tested recently. This is a three-storey reinforced-concrete structure of the flat-slab type, divided by columns into 20 x 22-ft. panels. The floor is 7 in. thick in the central portion of the panel and 9 in. throughout the area of 8 ft. 6 in. square surrounding each column, and is designed to carry a live load of 125 lb. per square foot. The columns are octagonal in shape, those of the basement storey being 25 in. in the short diameter and ending at the top in $3\frac{1}{2}$ -ft. flared heads. The columns of the storey above are 23 in. in the short diameter. The reinforcement, all of which is placed in the two directions parallel to the sides of the column, is designed to resist positive moment at the centers of all spans and negative moment at the columns and across the edges of all panels.

Originally nine panels were loaded to 191 lb. per square foot, after which the load was removed from six panels, leaving three adjacent central panels loaded. These three panels lie in a row and are one span removed from the exterior wall of the building. Finally, the load was removed from all but the central panel of the entire test area, where it was increased to 243 lb. per square foot.

Deformations were measured at 288 gauge lines and the results were very consistent among themselves. It was found that the condition of the three adjacent panels loaded gave steel stresses at the center of the span more than fifty per cent. greater than with nine panels loaded, and that the stress at the support was about twenty per cent. less with three panels loaded than with nine. It seems apparent that the tendency of the floor to deform as a cylinder instead of as a saucer, its action as a continuous beam and lateral distribution of stress to unloaded portions

of the slab all contributed to these differences between the stresses under nine-panel load and those under three-panel load. The results of the test seem to check the conclusion arrived at analytically—that the greater portion of the unbalanced moment was carried by the columns and very little by the slab. This conclusion is somewhat in conflict with the observation that there was so great an increase in the stress at the center of the panel when only three panels were loaded. In this respect it is typical of the generally observed fact that the results obtained from such tests are usually indicative of the general trend of results, but cannot be applied too rigidly as final conclusions.

Regina's New Telephone Exchange

REPRODUCED herewith is a photograph of the new telephone exchange building at Regina erected at a cost of nearly \$100,000. The telephone system is government-owned and the building was erected by the Saskatchewan Government. The dimensions are 85 ft. by 75 ft. and the construction is fire-proof throughout. The walls are built of Twin City brick with trimming of Bedford stone. The framework is of steel and the floors are of concrete. The main offices and the main halls are of tile. To eliminate the noise nuisance, which is always



New telephone exchange building, Regina, Sask. Architects: Messrs. Storey & Van Egmond; contractors, McKay Construction Company.

one of the disagreeable factors in buildings of this kind, cork composition is used in the floors. The main entrance is trimmed with stone and is surmounted by the crest of the Saskatchewan Government, carved in the same material. The interior trim throughout the building is of oak. The main entrance leads into a public hall 19 ft. by 40 ft., off which are situated general and private offices. The automatic system installed at Regina is very elaborate and the telephone equipment is complete in the minutest detail.

In the basement are located the power, heating and ventilating plants, all of which are of the most modern type. In connection with the generation of power, the possibility of a suspension of the telephone service has been adequately guarded against by providing what is virtually a power plant in duplicate, as it will be possible at any time, on a moment's notice, to transfer the "load" over to the city power. The plant in the exchange building consists of a 50 h.p. Diesel engine, which burns crude oil; a 30 kilowatt electric generator; two 30 h.p. electric motor generator sets (one as a reserve); a central switchboard for controlling, con-

verting and distributing the electric current, and motors in various parts of the building for driving the ventilating fan and bell ringing devices, and for lighting signal lamps.

In connection with the ventilating system, the air, on entering the large intake pipe, passes through steam coils for heating, then through a spray wall of water to cleanse it from all impurities, and lastly through another coil of steam pipes, this time to be dried. An exhaust fan at the top of the building draws out the foul air. In order to protect the delicate mechanism of the automatic switches, the large switch room has been fitted with double glass windows, and is virtually dust-proof.

Messrs. Storey & Van Egmond were the architects and the McKay Construction Company the contractors, both local firms. Messrs. Storey & Van Egmond were also the architects for the new power house at Regina, erected at a cost of \$425,000, and described in the Contract Record for November 26, 1913.

New Arts Building for University of Alberta

By Edward C. Mason.

THE contract has been let and the work of construction commenced in Edmonton for another large building for the University of Alberta. The new structure is the Arts building, and marks another stride towards the completion of the group planned four years ago. The main wing will be 300 feet long by 70 feet wide, with a rear wing



Proposed Arts Building, University of Alberta. Architects: Messrs. Nobbs & Hyde, Montreal.

for an auditorium 60 ft. wide and 93 ft. long. The building will be three storeys high, with an attic storey for the draughting rooms. The exterior will be red face brick, with stone trim, and a terra cotta parapet to match the limestone trim below. The outer walls will be furred with 3-in. terra cotta tiles, and all partitions are to be terra cotta blocks 4 in. thick.

In the basement will be the University press, a library with stacks, locker rooms, and a mining and testing laboratory. The approach to the main floor will be through a vestibuled entrance with marble pavement and granite steps, into the main hall, which will have quarry tile floors, ornamental terra cotta wall finish, and ornamental ceiling. The main floor will contain the Common room, a reading room, four class-rooms and three lecture rooms. On the second floor will be the Faculty room, the President's room, Geology and Mining laboratories; three lecture rooms, three class-rooms, offices and committee rooms. The hallway will have quarry tile floor, with terra cotta walls and vaulted plaster ceiling. The Faculty room is to be elliptical, 25 ft. by 33 ft., and two storeys in height with ornamental plaster walls and ceiling, oak floor and trim, and marble fireplace. On the third floor will be the Chemistry and Physic laboratories, also a Biology lecture-room and Research laboratory.

In the attic store at either end will be a draughting room, provision being made for two others in the centre. The roof will be a saw-tooth skylight over the draughting rooms, and also over the laboratories below. In the wing there will be a large assembly room, with lobby, stage, and organ, besides gallery and dressing rooms. The basement of this wing will be used as a fan room and storerooms. Hot air heating from a central plant will be installed.

The Architects are Messrs. Nobbs & Hyde, of Montreal. Prof. Cecil S. Burgess, of the Department of Architecture of the University, will act as Resident Architect. The contract for the building has been let to the Fuller Construction Company at \$428,000.

Protective Measures in Building Construction

IT is unnecessary to protect form work from the rain, as usually it is possible to get only green lumber, its tendency being to shrink out of shape rather than swell. Rough concrete never need be protected from the rain before setting, only from the concentrated run-off over some portion of the work which might wash deeply the cement out of a small area.

A troweled finish, however, must be protected against being pitted by the rain or damaged by concentrated streams. This is usually done by tarpaulin, which consists of 12-oz. cotton duck rendered waterproof after being made into covers 20 feet square. These are supported by a temporary frame. They are somewhat of an inconvenience to the finishers, and decrease the amount of work which they can do.

If rain is expected, it is usual to delay work until after the storm is over, if possible; otherwise, to build a shelter. Sudden showers require quick decision whether there is time to build a shelter, and also its cost, as compared to making repairs on the surface if left exposed. As a rule the shelter is built.

Protection From Sun

If there is to be an unavoidable delay in placing concrete after forms are erected, it is best to protect them from the sun if possible, because they shrink so as to open up cracks which permit the mortar to escape, leaving a bad surface on the concrete. Rough concrete does not require any protection from the sun, with rare exceptions. It is usual to cover up a granolithic finish for at least five days. The materials most available and most economically used for this purpose are rough bags, such as come around bales of cotton or wool, shavings, sawdust, and sand. The object of these is to retain the water which is put upon the surface to keep it wet and to maintain it at a fairly uniform lower temperature than direct sun action permits while setting.

The writer considers it unwise to spray bare concrete in the hot sun, and the use of roofing paper is but little better, because it retains moisture but a very short time. The water falling on a surface heated directly by the sun chills it suddenly, causing it to shrink, and may cause the very cracks which one is trying to avoid.

Protection from Frost

The aggregates must be free from frost when mixed. A live steam pipe can be shoved into the sand pile, the escaping steam heating it and removing all frost. The same may be done with the stone, but a canvas should be thrown over the top of the pile to retain the heat, which more readily escapes. Where a consider-



New warehouse of Revillon Bros., Edmonton, Alta. Architect, Mr. J. McDiarmid, Winnipeg. Contractors, Messrs. J. McDiarmid Company, Limited, Winnipeg.

able amount of heating is provided for in advance, steam pipes are laid on the ground, and stone as received is dumped upon them. Then there is a canvas thrown over to prevent storms getting into the pile, and to retain heat. The frost is thus easily and economically removed.

Salt is frequently used in the water to lower its freezing point. It is seldom worth while to heat the water itself. Little care need be used to prevent mass concrete from freezing, as the frost will usually only strike to a depth of about one inch. Buildings are enclosed with tarpaulin tied onto an outside staging, and the enclosed space is heated with salamanders burning coke. Sometimes it is possible to use steam.

Frost is removed from form work by the use of salt and steam, and if the concrete surface is left rough it is common to sprinkle the top surface with salt to prevent freezing. In winter it is very common to put the finish on as a separate operation, after the building is inclosed, and not as an integral part of the construction, on account of the danger of freezing. When it is put on, it must be kept from freezing for the first forty-eight hours.

The expense of protection against the weather is not very great, and good results can be so surely guaranteed that it is not usual for the writer ever to discontinue work on account of cold weather.

Occasionally it is necessary to make some provision for the protection of the men. Shelters or windshields are built in front of the benches where carpenters are making up forms, as well as around the men at the concrete mixer, whose work does not necessarily keep them warm. Where excavation is going on in the open, it is expedient to have a building with a good fire where the men can warm themselves when necessary; and on a few jobs it has proved to be wise to furnish hot coffee free in these shelters.

It is estimated that during 1914 an expenditure of \$60,000,000 will be made for road improvements in the Dominion. Of this amount more than \$30,000,000 is available for expenditure from appropriations made by the legislatures of the various provinces.

Warehouse of Revillon Bros., Edmonton

ONE of the largest warehouses west of Winnipeg is that of Revillon Brothers, merchants trading into the North-West. Though simple in exterior design, and with no pretence at interior finish, the building, which was completed in Edmonton during the past year, attracts immediate attention by its bulk and simplicity. The superstructure is reinforced-concrete, the mushroom system being used, allowing of the maximum head room and unbroken illumination. The exterior is of sand-lime brick, about 700,000 of which were supplied by the Alsip Brick & Supply Company, Limited, of Edmonton. In plan the structure is 135 feet wide by 150 feet long, and is six storeys high above the basement. Columns are spaced 19 feet by 20 ft. 6 in. On the first floor are the local offices of the company, sample rooms and receiving and shipping rooms. Two freight elevators and one passenger elevator are installed, together with a spiral gravity conveyor. The building was designed by Mr. Jas. McDiarmid, of Winnipeg, and was erected by the J. McDiarmid Company, Limited, of Winnipeg, at a total cost of \$250,000.

Water-Hammer in Steam Pipes

THE precise cause of water-hammer in steam pipes is not always fully understood. What, for example, is the approximate cause of the clicking in steam pipes? This is due either to the blows at pipe bends or valves of plugs of water in rapid movement or to collision of plugs of water upon water at rest, or to the collision of plugs meeting from opposite directions. This is all easy to understand, but one does not visualize that these crackings over the length of a long piece of pipe arise from collisions of plugs travelling perhaps many feet, the rapid crackling simply indicating the rapidity of the movements involved. We have to discover how the water is put into such rapid movement. To do this the motive power must be discovered. This may be steam, or it may be, secondarily, air. Steam is approx-

imately gaseous. Like all gaseous bodies it can be liquefied. But unlike the so-called permanent gases it will liquefy at such comparatively high temperatures as 212 deg. when at atmospheric pressures. According to the kinetic theory, a gas is merely an aggregation of extremely small molecules which are endowed by heat with the power of automobilism. Different gases possess different molecular velocities; for steam it is of the order of 1,800 ft. more or less per second, and the velocity of a mass of such molecules will depend upon the resistance against which they must make their way. In any cloud of steam surrounded by other gas at the same temperature the steam molecules are moving amongst each other, and those on the borders of the cloud are making their way slowly into the other surrounding gases. But if it be conceived that from one side of the cloud of steam all other gas be removed, then the steam molecules would have no molecules from which to rebound on that one side and would all rush down the empty lane.

This is what happens in a steam pipe: At some portion of the pipe there is water, cold relatively to the steam. Steam is admitted to the pipe and some of it condenses on the surface of the water, heating up the surface layer, which ceases to condense further steam. A valve is then opened in the course of the pipe; it is a valve against which, let us say, the water is lodging. The opening of the valve, allowing some water to pass, causes a disturbance of the surface, admits steam to the cold water, which promptly condenses so much steam as to produce a vacuum, into which steam rushes so violently that it piles up the water before it, and the wall of water is violently thrust forward by the steam and becomes a travelling plug of such energy that it is possible for great shocks to be set up which will readily burst or fracture cast-iron valves and other junction pieces.

The sequence of events above outlined is merely illustrative of what may happen, for the variations are as numerous as the ways of putting up steam pipes wrongly. One error formerly very common was to place a stop valve close to the boiler, taking off the steam by a vertical pipe to several feet high, when the pipe proceeded horizontally. This vertical pipe would be liable to become full of water if any steam could leak up into it from the boiler or condense into it from other boilers on the main. The correct position of the stop valve is at the top of the vertical pipe, and from it the main ought to slope all the way to engine separator. If there must be dips in between the

terminals, they must be drained, and the drain must act. Expansion bends, unless they project horizontally from a steam pipe, will block the flow of water and provide water to form a flying plug.

In designing any line of pipes or a system, all the possible combinations of opening, shut and leaking valves should be thought out to find if it is possible for water to collect. It is particularly desirable that the number of valves be a minimum. Numerous valves and ring mains are productive of danger points.

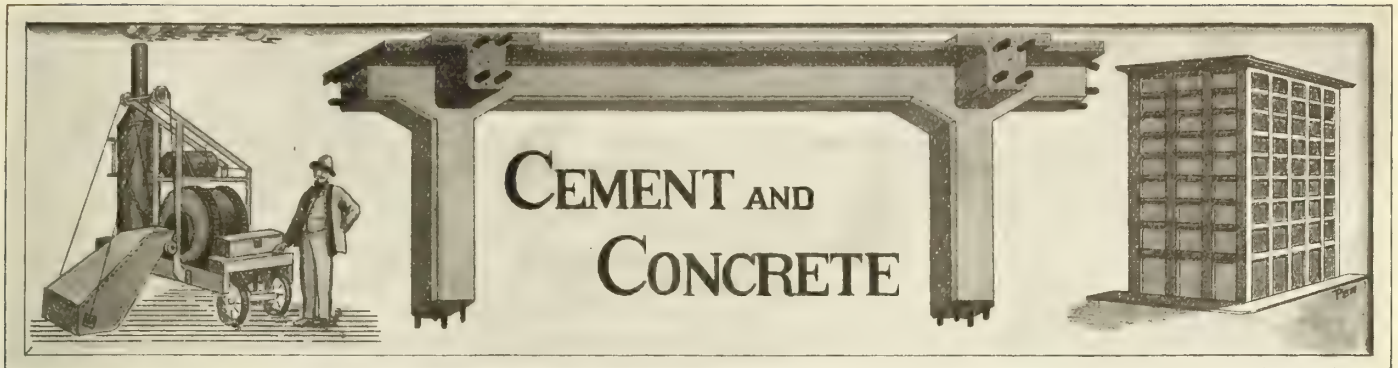
Where both air and water are present in a pipe it is possible for the air to be compressed at one end of the pipe, and for the compressing water to be flung back by the air into the steam end and do damage. Thus in a faulty arrangement the steam valve might first be opened slightly and promptly shut upon indication of trouble. And this very closing might produce a water-hammer by air rebound. Probably one of the more frequent hammer-causing faults is a slight slope of a pipe towards an obstruction with the formation of a long surface of water in a half-full pipe. This condition is one which might happen in a pipe which had been partially vacuum and nearly full of water. On admitting steam the traps would begin to lower the water, and produce the above conditions of a long surface to be broken into waves to set up rapid condensation.—Domestic Engineer.

Saskatchewan's New Provincial Gaol

REGINA is taking an important place in the constructional activity of the Dominion, judging from the many important enterprises which have been described in these columns during the last year or so. Particularly in building construction the capital city of Saskatchewan has established a claim to pre-eminence in the West. As the latest example of a number of important government buildings of recent date we reproduce a photograph of the new provincial gaol as it will appear upon completion. The contractors for this building are the Parsons Construction & Engineering Company, Limited, of Regina. The estimated cost of the administration block, chapel wing and south cell block—the portions of the building now under construction—is \$275,000. The north cell block will be constructed at some future time when required. The building has reinforced concrete floor slabs with steel and brick cells. The chapel is covered with a steel roof and the whole facing of the building is of brick and stone.



Provincial Gaol, Regina, Sask. Architects: Messrs. Storey & Van Egmond; contractors: Messrs. Parsons Construction and Engineering Company, Limited.



Concrete in Factory Construction^{*}

By Percival M. Fraser

IT is now generally recognized that a well-equipped series of shops is an absolutely essential factor in a successful industrial concern. It is as important as the machinery and plant and the site. It is not difficult to prove that these will be crippled by being housed in unsuitable buildings, where the first must be limited in efficiency, under-driven, and wastefully or harmfully worked, and the second so badly utilized as to counteract its peculiar merits. To be completely efficient it is necessary to be as thoroughly up-to-date in the buildings as in the plant, for to be up-to-date means to have taken advantage of every development and improvement in machinery and organization, and, other things being equal, indirectly it is the most important factor in success.

The attempted adaptation of groups of buildings to a use foreign to that for which they were designed is one explanation of the grotesque jumble of nondescript buildings dignified by the name of industrial buildings which we so often see, and it is one of the reasons why this country is unable to maintain its ascendancy in the world's manufacturing commerce.

It is also true that in the majority of cases economy could have been effected had the old buildings been scrapped and an entirely new series of buildings erected. I seriously suggest that the English factory owner requires educating in such matters as this, and that he has a great deal to learn from the United States on such points. The American will frankly admit that he does not build his factories for posterity, but is content if they last a couple of generations. I do not suggest that we are incapable in England of erecting efficient ranges of factories, and I trust that we shall never erect buildings which will depreciate 100 per cent. in fifty years, but there is a happy medium of design and expenditure in regard to factory construction which we should endeavor to seek.

There is a great deal that is incongruous in our industrial works. A typical English power plant represents the finest product of human workmanship, and the employees, from the chief engineer to the humblest stoker, take a pride in keeping it at its highest pitch of efficiency and scrupulously clean, for to their mechanical minds it is a thing of beauty; but this is ordinarily housed without scruple in a corrugated iron building, which is not only an eyesore but totally incapable of efficiently protecting the expensive

machinery it contains. I have in mind an engineering works where some new machine tools, very complicated and costly and requiring perfect conditions of lighting, space, and drive, are housed in a corrugated iron and timber-framed building which was purchased and erected at a cost of £60, having previously been a gymnasium in connection with a boys' club. It is unfortunately this type of construction which reinforced concrete has to compete with in cost, though it is evident that such a building is dear at any price and possesses only one advantage—namely, that it is easily pulled down by the factory owner when he eventually finds that no adequate return on the capital outlay of the plant is possible under such conditions.

The Design of Industrial Buildings

Among the questions which frequently come before an architect in designing industrial buildings is the following:—Whether the building as a whole should be one storey or more in height. This question is often automatically disposed of by the cost of land, the amount of labor to be accommodated, and the nature of the machinery. Unless the foundations are likely to prove abnormally expensive it will generally be found, however, that the one-storey building can be constructed the more cheaply.

A second important detail which practically always arises is the question of eliminating columns or reducing their number and planning their position to the best effect. When the engineer does not object to columns be sure he has evil designs on them, and ample strength should be provided accordingly.

Other questions which must infallibly arise are the nature of the lighting, which must, for many manufacturers, be from the roof. In two-storey buildings the width of the building is determined hereby, but it is an advantage to make the upper floor with roof light. Too much daylight, unlike artificial light, cannot be provided, but the increase of window space will add to cost and complicate heating and ventilation. The north or sawtooth roof is always an advantage, but is not always worth the expense, costing, as it does, 10 per cent. more than an ordinary pitched roof in steel or 20 per cent. more than a flat roof in reinforced concrete.

With regard to the clear height of workrooms, a margin should be allowed over the bare necessity, as it is comparatively cheap to add to the height of a

^{*} Abstracted from a paper delivered at a meeting of the Concrete Institute (London).

floor, and a lofty room conduces greatly to its general utility.

Advantages and Disadvantages of Reinforced Concrete for Factory Construction in Comparison with the Prevailing Methods of Construction.

The serious competitors of reinforced concrete which are at present before the building world are as follows:—

Brick, steel, and cast-iron, wood, sheet-iron, and metal lathing and plastering, tiling, terra-cotta, or similar slabbing and casing, and a number of patent forms of construction too numerous to mention and most difficult to classify, most of which, however, come within the scope of reinforced concrete in one or more respects.

It is exceedingly difficult, if not impossible, to definitely pronounce on the comparative economies of the foregoing materials, and we can only take specific instances and endeavor to generalize from these. I am able to give a case where competitive prices were obtained for a building, which is of a fair size, straightforward, and a really useful one for this comparison. In this case alternative schemes were prepared in the fullest detail and competitive prices obtained. The results were as follows:—

	Per cent.
1. For a steel-frame building with brick walls, corrugated iron roof (two-thirds north light), wood joists and boards on steel bearers to galleries, and patent glazing to roofs, the cost was	100
2. For a reinforced concrete building with roofs as last.	92
3. As last, but with concrete roofs, part flat, part with north lantern lights, but with brick panel walls..	89
4. As No. 1, but with corrugated iron walls	89
5. Wholly in reinforced concrete	88

The building was actually carried out in reinforced concrete, including the gutters, down pipes, roofs, walls, foundations, and every detail where it was possible for this material to be used. I may say that in this case there were no special circumstances whatsoever in favor of reinforced concrete; indeed, the question of the supply of aggregate was a very difficult one, as it had to be brought from 25 to 30 miles by rail. In my experience I have found that the foregoing figures will apply to all classes of ordinary buildings costing more than, say, £2,000. A building of less cost will, generally speaking, be found cheaper in some other form of construction, and I believe walls will nearly always be found cheaper in brick panels than in concrete slabs.

Maintenance

The freedom of concrete from deterioration permits of savings in maintenance charges. These are exceedingly great in large series of factory buildings, and can never be shown on paper. Maintenance means more than merely guarding against the ravages of time. The necessity for maintenance implies decay; the maintenance costs are a dead loss, and maintenance is in itself a thankless job owing to the fact that it is simply patched-up work, merely staying off the inevitable, which every year becomes at once more onerous and more useless.

There is no material that I know of where maintenance is not necessary. Good brickwork is perhaps as free from this as any material provided the bricks are carefully selected, well built, and pointed in ce-

ment. In such a case brickwork should remain without repair indefinitely. This also applies to stonework where not exposed to smoke and fumes, but the use of stone is so restricted that it need not be further considered.

With regard to the use of steel-frame construction, I strongly believe that, as carried out at present, it is liable to serious depreciation, and it has the very great disadvantage in that this depreciation cannot be guarded against or amended. A very large number of buildings are erected where the steel construction is cased in brickwork with no special precautions taken to protect the steelwork permanently against rusting. The continental system of building up with steel construction and filling the panels with brickwork, leaving the construction of steelwork exposed and painting same, is, of course, liable to depreciation, which must invariably destroy the structure in the course of time.

The various forms of patent slabbing for walls and roofs depend entirely upon an applied outer surface, and no such construction is found to be really permanent. It is always liable to cracks, through which the moisture can penetrate and attack the body of the walls, and the failure of the casing rapidly follows.

Considering, therefore, the claims of reinforced concrete, without wishing to be unduly enthusiastic, I think it may be reasonably asserted that, after a lengthy trial and the closest scrutiny of our chemists, architects, engineers, and constructors, reinforced concrete is, practically speaking, free from depreciation if constructed according to the latest approved practice.

Fire-Resisting Properties

The fire-resisting properties of various forms of construction are of paramount importance in factory buildings. The effect of fire-resisting construction in reducing insurance premiums is but a small matter compared with the damage which ensues to a business owing to the extreme dislocation caused by a fire, which no insurance can ever cover, for we have to consider the financial loss in the shape of buildings, plant, and machinery ruined, the destruction of office documents which cannot be replaced, and the permanent loss of many skilled workmen who are thrown temporarily out of work, and the occasional terrible loss of life. The output of a firm is, moreover, temporarily paralyzed, the normal trend of business is disorganized for a considerable period, and the eventual effect is that the insurance company will not reinsure at the same rates.

Nothing is, of course, fireproof, but we have to seek for the nearest approach to this ideal. Ordinary reinforced concrete construction is as efficient a fire resister as can be found. The metal is naturally guarded against by the concrete covering. There is nothing combustible about the construction; it is not liable to exercise a dangerous thrusting or overturning action, even when heated and suddenly cooled. It is, of course, liable when quenched with a strong shower of cold water to have the covering of slabs and beams either flake off or disintegrate. It is rarely or never found that any of the concrete, beyond the covering to the reinforcement, suffers any irreparable damage. Any such covering can be broken away where loose and the building restored after the conflagration. It can therefore be fairly claimed that for factory construction, which requires a high standard for fire re-

sistance, reinforced concrete can rival any other comparable method of construction.

A further consideration which applies mainly to warehouse buildings is the importance of affording the utmost floor space for the storage of goods. Construction in London is exceedingly onerous in this respect. Matters have been made considerably easier by the steel-frame amendment of the London Building Act, but it cannot be denied that a considerable encroachment on floor space can be avoided by the use of reinforced concrete walls and supports.

The objection to reinforced concrete, as compared with steel and cast-iron, in respect to posts and columns is that the floor space occupied is considerably more.

It should be remembered that if a steel stanchion is insulated against fire it would be practically as great in sectional area as a concrete column.

Adaptability

Perhaps the unique merit of reinforced concrete lies in its extraordinary adaptability. There is no other building material which can be put to such extraordinarily diverse uses without unwarrantable eccentricity or expense. The value of a material which can be used for practically any purpose which may arise in the construction of the wide variety of buildings comprised in industrial works need hardly be dilated upon. The practical economy of such a material is also evident. Provided there are no insurmountable difficulties in getting on to the site steel rods, timber, gravel, and cement, we have at hand constituents which are capable of being moulded into any shape and resisting any strain and fulfil purposes which collectively would require the use of a large number of different materials. In the ingredients of reinforced concrete there is nothing which cannot be readily obtained in the most remote locality of the kingdom. In my own experience, in places ten or more miles from the nearest station, concrete work always competed in point of economy with any other permanent form of construction, and wherever eccentric designs are to be carried out a plastic material will always hold its own with a material which has to be wrought into shape. And, indeed, it is difficult to conceive any form of building construction which it is not possible to carry out with reasonable economy in reinforced concrete.

Speed of Execution

Following on the adaptability of reinforced concrete is the speed with which construction can go forward. If a contractor will lay down a well-considered and efficient plant the rapidity with which a concrete job can go forward is remarkable. A larger number of workmen (mostly unskilled labor) can be usefully employed, and the building as a whole can be proceeded with uniformly and in a manner which simplifies supervision. Should it be found desirable in a steel or iron construction to make alteration, time is lost in waiting for the various revised members to be delivered. With reinforced concrete such deviations can readily be made.

Artistic Design

An objection which is often urged against concrete buildings, which does not apply to brickwork or the usual form of construction, is that it is by nature unsightly. If appearance is an object in a reinforced concrete building I do not hesitate for a moment to say that a very agreeable effect can be ob-

tained by perfectly legitimate and economical means. Those interested in the possibilities of beauty in reinforced concrete will do well to read Professor Beresford Pite's paper published in the Transactions of this Institute, Vol. III.

Another objection which may be held against reinforced concrete, especially for factory construction, is the great difficulty of making alterations which may be found necessary for various reasons, such as an expansion of business. But, in the first place, a successful factory owner should be able to see so far ahead that possible extensions can be provided for at the outset; secondly, that the practice of installing departments into buildings not intended for their use always produces inefficiency and undue expense; and, thirdly, that, assuming the building has to be altered owing to circumstances which no brain could have foreseen, such extensions and alterations are not impossible. Even if the expense of same is abnormal it is one of those factors which every shrewd business man will be prepared for, for, in the same way, he has frequently to throw on the scrap-heap a valuable machine which has been supplanted by something which saves more time or labor in output.

It cannot be denied that concrete, when it has settled down, is an exceedingly tough material, but the great strength to which this material attains should hardly be urged as an objection to its use.

Fixing Plant

The one great advantage of structural steel in factory construction is the ease with which machinery can be fixed to the steel members. That this use is often turned into abuse is beside the point, but I have frequently heard engineers state that they prefer steel to reinforced concrete for this reason. A little foresight will enable an architect to meet this objection with satisfaction to the factory owner. If an engineer desires to fix, say, a light motor he does not hesitate to drill a steel stanchion or girder as may be necessary to get a good fixing. By drilling two holes 1 inch in diameter in a girder he reduces a section as indicated on the diagram, whereas similar fixing on a concrete beam in theory has no effect upon the strength of the beam. In this respect concrete is advantageous, and it is at least as cheap as drilling in steel.

The bulk of a concrete member is so comparatively large in relation to a rolled steel member of equivalent strength that the resulting damage of cutting into such member is proportionately reduced. Comparing the members shown, the sectional areas of the steel joist and of the concrete beam are in the proportion of 1 to 7 for equivalent strengths. It is obvious, therefore, that the concrete member will stand much more mutilation without jeopardising its strength than the steel joist. Provision should and can readily be made, therefore, for fixing to soffits of slabs or beams.

A simple means of providing for light fixings is obtained by casting a groove in the beams and columns, so that a fixing can be obtained with the greatest ease without in any way having to go into the concrete. For gas or water-pipes and mains or cables of any description this fixing is very simple, and a good engineering job; again, the indiscriminate fixing of shafting to walls is accompanied with greater safety on reinforced concrete slabs than on brickwork, which is liable to give along the joints, and the weight, of course, is not so evenly distributed.

The low thermal conductivity of concrete gives it an advantage over the ordinary forms of roofing, apart

from other considerations. The usual precautions taken are to construct a roof of timber with thick boarding overlaid with felt, upon which are placed battens and counter-battens and thick slating. This forms a fairly effective insulation, but the construction is at least as expensive as a concrete flat asphalted. For flat roofs and in all places where exposed to

damp or water pressure concrete can be made, with due care, absolutely waterproof, and a very valuable and convenient arrangement which is now often adopted is to construct concrete roofs with high parapet walls and utilize them for water storage. This has a further advantage that the water is generally at a convenient height to be drawn off under pressure.

A Practical Discussion of Reinforced Concrete Pavements

By B. S. Pease*

THE formation of cracks in concrete pavements is the conspicuous fault of a type of pavement low in first cost, offering slight resistance to traffic, while preserving a satisfactory traction, even on steep grades, and possessing a high sanitary value. Cracking may be induced by three factors—poor foundations, contraction during the setting period and natural expansion. The commonly used method of hindering cracking is by building the pavement in small units, with joints, but this is expensive and the joints are unsightly and not durable. Even when protected by steel plates, the line of cleavage is the weak portion of the wearing surface, and it is there that deterioration first occurs.

Steel reinforcement, though its use for pavement dates back only three or four years, appears capable of preventing the formation of cracks under all conditions when properly proportioned and placed. In 1913 at least fifty-six municipalities contained construction of this type, one and two-course pavements being about equally divided. The performance of these pavements indicates the ability of reinforcement to counteract the principal causes of cracking.

Theory of Pavement Reinforcement

Consider those pavements that will be laid on a questionable foundation. The necessity for reinforcement to give structural strength to the slab is evident, regardless of whether the foundation is poor in spots or over the entire area. If the foundation consists of filled material, it is almost impossible, even by the use of a heavy road roller, to prevent future settlement, and no one can tell at what points the settling will occur.

An excellent example of this class of work is shown by a pavement built on spongy land in Oakland, Cal.—a 6-in. slab reinforced near the bottom with a steel mesh, the type most commonly used. Upon especially soft spots a second thickness of the wire fabric was laid at right angles to the other. This roadway is giving good service under a heavy traffic.

In the construction of country roads a part of the metal will usually extend outside the old beaten track, and therefore the foundation will be more compact under the center portion. Even if the center be scarified and rerolled it will be almost impossible to secure a uniform result. This condition in itself will allow a settlement at the outer edges and cracks will form longitudinally unless suitable reinforcement be used near the top of the pavement. When a pavement contracts in setting or because of a reduction in temperature, cracks will form at more or less regular intervals, the distance between them depending

largely upon the tensile strength of the concrete. It is for this reason that many engineers advocate a definite close spacing of expansion joints. At the same time they concede that these joints are the weak spots in the pavement; if some other method of construction could be used, therefore, so that the number of these joints could be reduced, its merits should be studied.

Position of Reinforcement

As concrete in itself has no dependable tensile strength, it is necessary to include a reinforcement to supply this deficiency. For several reasons the practice has been to place this reinforcement near the top of the slab. For a two-course pavement the logical position is between the base and wearing courses, where it will not only resist expansion and contraction of the entire slab but will also act as a connecting link between two bodies of concrete having a different mixture of the ingredients and will prevent the formation of cracks along the crown. For single-course work the reinforcement is usually placed about 2 in. below the surface. Although this type is called single course, it must of necessity be placed in the layers in order to include the reinforcement.

The amount of reinforcement to use may vary with conditions, but the limited practice suggests that for country roads, if the expansion joints are placed not more than 30 ft. apart, sectional areas of .049 sq. in. per foot of width crosswise and .038 sq. in. lengthwise of the pavement will furnish sufficient resistance to prevent cracks due to shrinkage during setting, expansion or contraction from temperature changes, or any ordinary inequality of the foundation soil.

Spacing of Joints

The subject of proper spacing of expansion joints should be studied in connection with the consideration of the reinforcement, for the reason that the greater the spacing of joints the greater should be the amount of longitudinal steel.

Past experience points to the fact that the principal change in the length of a concrete pavement is a contraction, and the steel, although it has approximately the same coefficient of expansion as concrete, and will therefore change in length about the same amount, will prevent the shortening effect from being localized at definite intervals and will distribute the total change into innumerable small cracks that will not decrease the wearing qualities of the finished pavement. If the expansion joints are spaced at a greater distance than 30 ft. the amount of longitudinal steel should be increased to at least .1 sq. in. per foot width for spacing up to 100 ft., and the writer thoroughly believes that by the addition of a sufficient amount

* Engineer for the American Steel & Wire Company, Chicago.

of longitudinal steel reinforcement it would be possible to construct a roadway without any expansion joints.

For street pavements the early practice was to use a very light reinforcement, but the more recent ones have made use of a heavier material, even for close spacing of expansion joints. In fact, the tendency now is to increase the weight of reinforcement, and since this item is small in comparison to the total cost of the finished work it would appear to be poor economy to use a light material when for a slight additional expense a proper construction can be assured. The average cost for the reinforcement in place ready for concreting varies from 7 to 15 cents per square yard, depending upon the weight of reinforcement used. The same recommendations and the reasons therefore that have been given for necessary reinforcement for country roads will also apply for city pavements, with the exception that, regardless of the weight of reinforcement used, expansion joints will be required at all street and alley intersections or wherever connected with any permanent rigid construction.

Method of Laying a Concrete Floor

TOO much care cannot be exercised in preparing the foundation for a concrete floor, comments a writer in *The Building Age*. This should always be well drained, and firmed to a depth of from 6 to 8 in. below the concrete. It pays to tamp this foundation thoroughly before putting on the mixture. If the soil contains a great deal of clay, it may be necessary to remove part of it and to fill in with broken stone, gravel or cinders to within 4 or 6 in. of the proposed finished surface, depending upon the thickness of the floor. Blind drains of coarse gravel or tile may be laid from the lowest points in the excavation to carry off any water that may accumulate beneath the structure.

For the construction of the ordinary stable or barn floor, which is not to carry any great weight, the following proportion is to be recommended for the concrete base, says H. M. Bainer, of the Colorado Agricultural College: One part cement, $2\frac{1}{2}$ parts clean, sharp sand, and 5 parts loose gravel or broken stone. This should be finished on the surface with a 1 to $1\frac{1}{2}$ in. layer of a mixture of 1 part cement and $1\frac{1}{2}$ to 2 parts of clean, sharp sand. The total thickness of this floor must be from 5 to 8 in., depending upon the load it is to carry.

For engine foundations, floors, or driveways over which heavy loads pass, the following proportion is to be recommended: One part cement, 2 parts sand, and 4 parts broken stone or gravel.

Constructing Large Floors

For all large floors, it is advisable to place the concrete in sections not to exceed 6 ft. square. This may be done by placing a 2-in. plank of a width equal to the desired thickness of the floor on edge, as a box in which the concrete is tamped until water begins to show on top. Make several of these forms, holding the plank in place by means of stakes driven into the surface. These stakes should be driven on the outside of the form so that they can be easily removed after the concrete has partly set and the planks have been taken out. Fill alternate forms at first, tamping the concrete thoroughly, especially the edges. As soon as the concrete has partly set, remove the plank and fill

in the forms not filled at first. Mark the side plank to show exactly where the joints come.

The finishing coat should be spread on before the concrete has set. To make this of uniform thickness it is best to place either 1-in. or $\frac{1}{2}$ -in. wood strips, as is desired, on top of the concrete, over which a straight edge may be run. Smooth with a trowel for a smooth surface, or with a wooden float for a rough surface. Groove exactly over the joints of the concrete so as to level the edges of each block. Do not trowel the surface too much, as it tends to separate the cement from the sand and injure the wearing surface.

The floor should be constructed with slope enough to carry all liquids to certain points from which they may be drained. Protect the new floor from the direct rays of the sun, currents of air, and frost; and keep constantly moistened for several days. Water is very important in the curing of concrete construction, and must be liberally used.

Use nothing but the best cement that can be obtained. The sand should be clean, sharp and not too fine; it should be freed from loam or clay, as these will tend to destroy the adhesive quality and retard the setting of the concrete. Use only pure water for mixing. Mix thoroughly. Water thoroughly. Cure thoroughly.

New Post Office, Mount Pleasant, B.C.

THE new sub-post office which the Dominion Department of Public Works proposes to establish in the Mount Pleasant district, Vancouver, during the present year, will be a substantial structure of dignified outward appearance, possess-



Proposed post office, Mount Pleasant, B.C. Architect, Mr. A. Campbell Hope, Vancouver.

ing admirable features of design and construction. Reinforced concrete will be employed for the construction of the building, and every precaution will be taken to render it absolutely fireproof. In addition to the exterior walls, the floors, beams and interior walls and columns will be of concrete and most of the windows will be fitted with wired glass and metal frames. The structure will measure 73 x 88 feet and will be erected on the corner of 15th avenue and Main street, a site, which on account of its commanding elevation provides an unobstructed outlook over the city. Ac-

According to the limited details available, the exterior facing of the basement storey will be rusticated stone and the succeeding storey will be faced with stone of finer grain and different tint in strongly-marked horizontal courses, finished above the ground floor windows with stone interpreture. This will be surmounted by a structure of faced brick having stone pilasters and window trim with suitable carved and ornamental work. The roof will be of a non-combustible material with copper trim. Hot water heating and a modern plumbing system will be installed. The ventilating is to be of the direct indirect type, with extraction fan in the clock tower. The building will be equipped with a two-pipe motor vacuum-cleaning system. The public space on the main floor will be fitted up in attractive style with a good class Canadian marble as a nine-foot wainscoting for the walls and columns. The ceiling and the balance of the walls in the post office proper will be of plaster, and interlocking rubber tile is to be used for the floor. A marble staircase will lead from this floor to the offices in the upper storey. The interior woodwork has not yet been decided upon, but it is believed that the Department will sanction the use of a finish of B. C. growth. Plans and specifications of this building have been completed, and it is expected that tenders for the construction will be called for during the coming spring. The estimated cost of the work is \$100,000. Mr. A. Campbell Hope, Vancouver, prepared the plans.

An estimated annual waste of \$750,000 in the construction of buildings in Toronto, as the result of unnecessary exactions by the building laws, is charged by Prof. C. R. Young, of the engineering department of the University of Toronto, in a report recently prepared by him. According to Professor Young steel construction costs from 3 to 8 per cent. and reinforced concrete 5 or 10 per cent. more than it would with reasonable and at the same time safe specifications.

At Leeds University, last month, Professor Goodman, lecturing on "Engineering Problems in the Pyramids," referred to the marvellous accuracy of the orientation of the Pyramid of Cheops, which faces almost exactly north, south, east, and west, and was probably used as an astronomical observatory. The granite and other stone blocks were worked with copper chisels, but how the chisels were hardened nobody could say. Sir Benjamin Baker and Sir John Aird, who built the Assouan Dam, agreed that Herodotus had made a reasonable estimate in stating that 100,000 men were employed three months a year for twenty years, and that 4,000 masons were constantly at work preparing the stone. Barracks had been discovered which would accommodate about 4,000 men.

Engineers' Club of Toronto—Annual Dinner

Evidences of keen enthusiasm in the constructive work that is being accomplished by the Engineers' Club of Toronto were provided in abundance at a representative gathering of the members at the annual dinner held on Thursday, March 12, at the headquarters, 94 King Street West, Toronto. The president, Col. Van Nostrand, occupied the chair and the speakers included Messrs. Willis Chipman, L. V. Rorke, Arthur Hewitt, C. H. Heys and W. A. Bucke. The gratifying announcement is made that the directors have secured a site on University Avenue for the erection of a new Club

building. Enterprising measures looking to the erection of an up-to-date building will be taken at once. The speeches were enlivened by the interspersing of song and story.

The Principles of Efficiency Engineering Applied to Highway Engineering

By Frank B. Gilbreth, Consulting Engineer, New York City

IT is a fortunate thing for engineers that from its very start Scientific Management was understood to apply to the work of the engineer. It has been the custom for some years to ascertain the science of management especially with shop work and to believe that its principles are most successfully applied in manufacturing, but, as the breadth of the field of application of the principles of Scientific Management has become better understood, it has been realized that there is no field of activity to which the principles do not apply and that there is no type of work, office work, shop work, field work, manufacturing, constructing, selling, advertising, etc., which cannot be done better, if the theory of Scientific Management be understood and the practice of Scientific Management be applied.

Principles Defined

The principles of Scientific Management have been defined by Mr. Taylor as four:

1. A development of a science for each element of a man's work, which replaces the old rule of thumb method.
2. Scientific selection and training of the workmen.
3. Hearty co-operation between management and men.
4. An almost equal division of the work and the responsibility between the management and the workmen.

This order is that of the development of the science of management. For purposes of installation we might change the order a little, and say that we are to do four things:

1. To functionalize the work so that each member of the organization does that part of the work that he is best fitted to do.
2. To inculcate that spirit of co-operation that will make each member willing to do the work that is assigned to him.
3. To standardize.
4. To teach each member of the organization so that he can best perform his part of the work.

Having thoroughly laid out the problem on the human side and on the material side, and laid out a method of attack to the desired result, it is necessary, before actually making any changes, to insure the hearty co-operation of every member of the organization. This is done by various methods.

1. By an educational campaign, by explaining so far as is desirable and desired the entire plan of Scientific Management and the plan of application to the line of work attempted.
2. By beginning the actual work so far as is possible on the management side. This for two reasons.
 - (1) The management side in the majority of cases needs the work most.
 - (2) The men will be much more willing to have the system applied to them, if they see it being applied to the management.

Co-operation, once secured, can be held by seeing that every step is made in the open and by seeing that every man receives a suitable, prompt, assured reward for everything that he does.

Concerning Standardization

Having laid out your plant and secured the co-operation

* Lecture delivered by Professor J. Ansel Brooks, of Brown University, before the Graduate Students in Highway Engineering at Columbia University, March 2, 1914.

of your men, it is necessary to standardize. Standardization consists of two parts:

1. Securing a standard.
2. Applying the standard.

I will consider the application of the standards first as the subject is less technical, and as so many standards have been already established that you will be able to apply the result of the work of others in many cases before finding it necessary to take the actual measurements and find the actual standards for yourself. Devices, while they must in no way be confounded with the science of management, are excellent in applying the principles of standardization. According to the rule just given—that work should be done on the management side first—I will show you a few office standards which may be easily established and which will help the management and office force to visualize the problem of standardization. In themselves these devices are nothing; as showing the importance of the principle of standardization they mean a great deal. The cross-sectioned desk with its standardized equipment, and the arrangement of the various drawers for the various types of work will not only interest everyone about the plant, but will so substantially cut down the work of all using them as to insure sympathy with as well as interest in the work. More than this, in our personal experience they have inculcated a spirit of “thinking in least motions,” a better method of attack, which has proved a most valuable asset. This same spirit has been the result of the installation of standard devices in the shop. I will show you the bulletin board, which applies both to the planning and the performing department, the tool room, the tool stand and the assembling packet. The bulletin board is universal in its field of application. There is no one in the organization

whose work may not be handled on the bulletin board. It thus serves as a unifying point as well as a standard method of handling work. The tool room, while actually operated by but a few men, affects the work of the entire performing department and is an admirable object lesson as to the benefits of standardization. The assembly packet, while invented to cut down the motions of the assembler of a braider, illustrates a principle of so placing material that it can be handled with the greatest care that is, as you can readily see, applicable to every type of work.

We will turn next to the derivation of these standards. They are the result of that accurate measurement that gives management its claim to be a true science. The methods of measurement, as you know, are time study and motion study. Time study, upon which the science of measurement hangs, is a determination of the elementary unit times necessary to perform an operation. Motion study is the determination of the proper elements to be timed. The two are parts of one whole, i.e., accurate measurement.

Last, but not least in importance, we come to the training or teaching of the men. This is done, directly, through instruction cards and through the functional foremen, who are all specialist teachers; and, indirectly, through the installation of Scientific Management itself. Everyone in the entire organization, management and men alike, if the installation have been properly done, becomes interested in the science of management and in the method of attack which it employs. This interest is the greatest educative force in Scientific Management. If you develop this interest in the subject, the application of the principles of the science of management to your specialty is bound to result not only in success to you individually but to the profession to which you devote your lives.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

A supplementary vote of \$100,000 is to be made to Leamington for the building of a breakwater outside the harbor in Lake Erie.

Montreal building work upon which tenders closed last week included a college building estimated to cost \$400,000 for Loyola College.

Mr. M. H. Braden is the contractor for the three-storey customs house building to be erected at Fort William, Ont., at a cost of \$175,000.

The new R. C. church at Chicoutimi, Que., erected at a cost of \$325,000, according to the plans of Mr. R. P. Lemay, Quebec, is nearing completion.

The National Amateur Athletic Association of Montreal, Que., have plans in hand for a new club-house estimated to cost a quarter of a million dollars.

If the plans of Montreal Agencies, Limited, materialize, another apartment house will be erected in Montreal this season at a cost of \$1,000,000.

The steel work of the new post-office at St. John, N.B., is completed. The estimated cost of the building is \$500,000. Mr. G. E. Fairweather, of St. John, is the architect.

The million-dollar carbide plant at Welland, Ont., which

is being erected for the Union Carbide Company by the Lackawana Bridge Company, Buffalo, N.Y., is nearing completion.

Sydney, N.B., is to have a \$125,000 technical school for which preliminary plans have been prepared by Professor F. H. Sexton, acting on the instructions of the Board of Education.

The Algoma Steel Corporation, Limited, Sault Ste. Marie, will receive tenders about May 1 for open hearth furnaces at Steelton, Ont. The cost of the work is placed at \$250,000.

The Starrett Company, Detroit, Mich., have the contract for the new factory buildings of the Canadian Alkali Company, Limited, to be erected at Sandwich, Ont., at a cost of \$2,000,000.

Montreal contractors will be asked to tender next month on an apartment house for which Messrs. Gauthier & Daoust, architects, have prepared the plans. The cost is placed at \$200,000.

Mr. A. E. Anderson, Montreal, is the architect for two stores and a theatre to be erected at St. John, N.B., at a cost of \$120,000. Tenders for the work have been submitted and are now under consideration.

The parish of St. Eusebe de Verceil, Montreal, is contemplating the erection of a church at a cost of \$150,000.

The architects, Messrs. Beaugrand, Champagne & Chenevert, will call for tenders about May 1.

Excavation work has been commenced on St. Paul's new club house on the north side of Queen Street East, Toronto. The structure will cost between \$40,000 and \$50,000.

Building permits issued in Hamilton for the month of February amounted to \$163,100 as against \$152,500 for the corresponding period of last year. The increase for February is \$42,000 over that of the same month in 1912.

From the report of the Minister of Public Works we learn that the expenditure on permanent bridges in New Brunswick during the year was \$525,123. On railway roads and bridges the outlay totalled \$319,565. The expenditure on roads was \$272,500.

During the year 1913, 260,000 tons of gypsum were shipped from Windsor, N.S., to New York. This year it is expected the output will be increased considerably, and everything points to the fact that the industry is growing rapidly in that part of the Maritime Provinces.

According to a recent report approximately sixty million dollars is available for the improvement of the roads of the Dominion of Canada during the present year. Of this sum more than half is available for expenditure from appropriations made by the legislature to the various provinces.

The hydro-electric radial field day convention passed resolutions at London, Ont., on March 5, calling upon the Dominion Government to assist the hydro railway scheme to the extent of \$6,400 a mile, and requesting that the plans for furthering the deep waterways projects be favorably acted upon.

The emptying of the Lachine Canal which took place this year a month earlier than usual, to allow work on a power plant at Cote St. Paul's to be carried on by the government, is said to have resulted in serious inconvenience to several manufacturers whose plants are located on the banks of the canal.

Mr. B. C. Munnings is contractor for the new revolving flash light which the Dominion Government has decided to place in Goderich harbor. The old light-house which was erected over eighty years ago is being partially demolished to accommodate the new structure. Mr. K. G. Eagan, of Ottawa, is in charge of the work.

The inland marine interests in Montreal are considering the desirability of constructing a new drydock in the canal basin, claiming that the present drydock is not large enough to accommodate the present boat traffic on the canals. The project is at present in the hands of the harbor and navigation committee of the Board of Trade.

A law suit has been begun in the Brooklyn supreme court by Mr. Walter G. A. Hemming against Mr. James B. Craven, an engineer, for half interest in the contract given by the Canadian Government to Mr. Craven, to improve St. John harbor. The contract, which involves about \$3,000,000, was subsequently assigned to the Norton-Griffiths Company of England.

Mr. Harris, city commissioner of Toronto, has supplied plans for renewing the bridges on Strachan Avenue over the C. P. R. and G. T. R. tracks, and raising the elevation of the roadway sufficiently to give a standard Dominion clearance of 22 ft. 6 in. over the base rails. The estimated cost of the work is placed at \$114,300, and debentures have been authorized for \$58,200.

A deputation from New Ontario waited upon the Dominion Government recently to urge the taking of steps to develop the deposits that are scattered through the Lake Superior country, and also to assist the iron industry in that part of Canada. The deputation, which was headed by the

mayor of Sault Ste. Marie, represented the associated boards of trade of northern Ontario.

Over thirty architects from Toronto, New York, Ottawa, Montreal, Sherbrooke, Three Rivers and Quebec, are likely to submit competitive plans for the new fireproof-concrete grand stand which the Quebec Exhibition Commission are about to erect at an estimated cost of about \$100,000.

Engineering and building interests were strongly represented at the annual dinner of the Technology Club of Lower Canada held in Montreal. Among the toasts were "Building Construction along the C. P. R.," responded to by T. E. Videtto; "Electrical Engineering in Canada," W. J. O'Leary; "Transportation Problems in Canada," Prof. Keay; "Tunnel Work in Canada," S. P. Brown; "Pleasures of Municipal Engineering," G. R. Heckle; and "Montreal Architecture," G. T. Hyde.

Mr. Beckwith, assistant government engineer, was in North Sydney, N.S., recently, consulting with the resident engineer regarding the location of the proposed new bridge line of the Intercolonial Railway from that town to Leitches Creek. New deep water terminals are also to be built at Sydney and in connection with both projects surveys are being made with a view to preparing estimates of cost of construction. Reports and recommendations will be laid before the next session of Parliament.

In connection with the Montreal conduit break controversy a special meeting of the enquiry, under the presidency of the mayor, was held on March 4 to hear the views of Mr. Rodger Miller, of Ingersoll, Ont. Mr. Miller, who is a concrete expert who has had long experience in the use of concrete in canal construction from Sault Ste. Marie to the Soulanges canal, bore out the contentions of chief engineer Janin that the break was due not to the inherent weaknesses of the structure, but to the working of the drag-line excavator nearby.

The Maritime Dredging Company have begun work levelling off some of the cribs already sunk in preparation for the concrete walls which will be built by the E. G. N. Cape Company, for the new Carleton wharf at St. John, N.B. A cargo of about one million feet of hard pine is being shipped to St. John from the southern states, the intention being to use this pine until the arrival from the woods of the New Brunswick timber which has been contracted for during the present winter. There has already been built and laid 1,523 feet of crib work, and the remainder in order to fill the contract for this year amounts to 2,390 feet.

Two new berths will be available at West St. John for the next winter season, according to plans now under way for better accommodation. One of the berths, which will be 860 feet long, will be equipped with a modern steel warehouse. Preliminary work prior to the construction of the new wharves at Sand Point is now under way and the C. G. M. Cape Company will carry the materials for the concrete to the mixers by means of a train of small cars drawn by construction locomotives, the mixers to be run continuously. The larger wharf will be 850 feet long, the other will have a length of 600 feet extending on a line with the old Canadian Pacific Railway pier.

A feature of the proposed improvements by the city of Westmount, P.Q., is the new lighting scheme and the construction of conduits. Recently the city installed a number of magnetite arc lamps in a portion of the city, a conduit being constructed to carry the wires and also those of the police and fire departments, besides those of the power companies. It is now proposed to extend this conduit system on all the main thoroughfares and to provide standard lighting. Conduits will be laid in the boulevards and lanes, and the unsightly poles abolished. It is also proposed to build a new

city hall, at a cost of \$271,000, of which the building will absorb \$184,000. Besides paving lanes, opening up new streets and extending thoroughfares, the council desire to do a large amount of general road work, and to purchase additional plant, including motor trucks and flushers.

Negotiations for an adjustment of wages are proceeding between the Montreal Builders' Exchange and the Building Trades Council. Recently the various trades united in a federation, and they now have made demands for a higher scale and for a reduction in hours. The following is the present scale and the increases asked for:—Structural iron-workers, 35 to 45 cents an hour; tilers, 45 to 55c.; plumbers, 40 to 42½; steamfitters, 35 to 42½; plumbers' help, 15 to 25; marble cutters, 40 to 45; marble setters, 40 to 45; painters, 35 to 40; tinsmiths and roofers, 30 to 40; cement finishers (foremen), 40 to 45. At present only three sections of the Building Trade have agreements with the Builders' Exchange, and others are now asking for these—at, of course, the higher scale. It is also suggested that an arbitration board should be formed, with the object of avoiding strikes and lock-outs. The masters are not inclined to accede to the full requests of the men, especially as they believe that the building programme this year will not be very extensive. The cost of building in Montreal is already very high, and to increase the wages as demanded is calculated to discourage operations, particularly as regards important structures.

WESTERN CANADA

Operations are starting on the new Grand Trunk Pacific depot at Calgary, estimated to cost \$300,000.

Construction work on the \$1,500,000 Government Elevators at Moose Jaw, which has been held up during the cold weather, will be resumed as soon as the weather permits.

Good progress is reported on the preparation of plans for the new seventeen-roomed school at Edmonton, Alta., to be built by the Public School Board at a cost of \$150,000.

Messrs. Carter, Halls & Aldinger Company, of Winnipeg, have the contract for the completion of the hotel building for the Olympia Cafe Company. The estimated cost is \$400,000.

Medicine Hat, Alta., is to have a new 6-storey business block. The structure will be of reinforced concrete and will cost \$225,000. Mr. A. Dickinson, a local architect, has the plans in hand.

Under the direction of the Secretary of the Department of Public Works (Mr. R. C. Desrochers, Ottawa), plans are being prepared for a customs house to be erected at Regina, Sask., at a cost of \$200,000.

A report to hand states that shipments to the Consolidated Company's smelter at Thail, B.C., for the week ending February 28, totalled 8,207 tons, which is nearly 1,000 tons above the average for the first eight weeks of 1914.

The new school building at Oak's Bay, B.C., which was opened recently involved an outlay of \$80,000, to which the Provincial Government has contributed \$40,000. The building was designed by Mr. C. E. Watkins and built by Luney Bros.

Permission is to be given by the City of Victoria, B.C., to the Hudson Bay Company to instal below the surface of the roadway storage tanks for fuel oil to be used for heating purposes in the new stores to be built by the company on Douglas street, Victoria.

Saskatoon's constructional programme for 1914, as already outlined, involves an expenditure of between four and five millions. The municipal engineering department will spend \$554,850, while the larger buildings already planned involve an outlay of over four million dollars. It is fair to as-

sume that Saskatoon will benefit considerably from the increased activity which will be experienced in the district between Saskatoon and Calgary upon the operation of the new C. N. R. line between these cities.

The Lang Cove site for a government drydock at Esquimalt will be immediately purchased following an order-in-council passed at Ottawa. The dock is to be eleven hundred feet long and the preparation of plans and specifications is to be proceeded with right away.

At a cost of about \$130,000, the Parsons Construction Company have completed a new Winter Fair building at Regina. It is 320 feet long by 200 feet wide and is of brick and steel construction. The judging amphitheatre is 220 feet by 85 feet, and seating capacity is provided for 5,500 people. A steam heating plant has been installed at a cost of about \$20,000.

Dr. G. A. Ings, who is promoting a big power project up the Elbow River in connection with coal and iron schemes in Alberta, has suggested that if the City of Calgary proceed with the scheme of bringing a new water supply from the mountains they should enter into a joint water power and supply scheme. The proposal is to erect a big power dam which will save the city the cost of building a storage dam. The water supply will be taken from the tail race of the power dam.

The Burrard Peninsula Joint Sewers Commission plans the expenditure of over \$2,000,000 in Greater Vancouver during the present year, according to a statement by Mr. Frank Bowser, chairman of the commission. Of this total the approximate outlays will be \$1,000,000 in Vancouver, \$750,000 in South Vancouver, \$100,000 in Point Grey, and \$100,000 in Burnaby. The intention of the board is to do the early work along the lines of density of population where improvements are necessarily imperative. Extension work is also contemplated in connection with the Balachlava trunk sewer.

An event which exemplifies the phenomenal growth of Calgary is the construction of the Hotel Paliser, for the Canadian Pacific Railway in that city. The hotel was started in the winter of 1911-12, and will be ready for opening in May. Externally the building is French Renaissance. Buff pressed brick, Roman size, is used for the facing of the walls, while the trimmings are of Indiana limestone. Its ground measurements are 227 feet by 145 feet, rising to a height of 120 feet above the sidewalk. It comprises ten floors—basement, ground, mezzanine and seven service floors, with a garden and sun parlor on the roof. The structure is of steel and reinforced-concrete throughout. Altogether there will be 315 bedrooms and 278 bathrooms. A feature of the building is the installation of a maids' signal system between the office and other parts of the hotel. The heating in use throughout is the direct-steam system, the principal rooms being under a system of temperature regulation. The architects are Messrs. E. & W. S. Maxwell, and the contractors F. Lyall & Sons Construction Company.

Mr. J. A. Weller, C.E., engineer-in-charge of the new Welland canal, recently gave an interesting address before the Ottawa branch of the Canadian Civil Engineers at Ottawa, on the subject of the engineering difficulties that have been overcome in connection with the construction of the Welland canal. He announced that it was expected that all contracts would be completed in time to allow for the opening of the canal in 1918.

Mr. J. H. Larmonth, general manager of the Electric Power Company, Limited, Toronto, has been selected as the new superintendent of the Edmonton Street Railway, to succeed Mr. W. T. Woodroff, resigned.

Personal Mention

Mr. J. W. Lyon was elected president of the Guelph Radial Railway Company at the annual general meeting held on March 10.

Mr. E. W. Cox has been elected to the board of directors of Canada Cement Company in the place of his father, the late Senator Cox.

Messrs. Langley & Howland, architects, are now occupying new offices in the North American Life Building, 112 to 118 King Street West, Toronto.

Mr. Alfred M. Wright, the Montreal manager of E. T. Giberson & Company, Limited, Bedford Indiana limestone, has been elected vice-president of the company.

Messrs. Ross & Macdonald, architects, Montreal, Toronto and Winnipeg, have removed their Winnipeg office from 928 Union Bank Building to 508 Tribune Building.

Mr. G. Sylvester, of Calgary, has been elected president of the Alberta Provincial Builders' Exchange for the ensuing year, and Mr. H. J. Goode, Lethbridge, vice-president.

Mr. Vincent Simpson, of Gerald Lomer, Limited, Montreal, Canadian sales agents for the Phoenix Steel Works, Dusseldorf, Germany, is now in the West on a business trip. He will visit Edmonton, Vancouver, and other cities in the Western provinces.

Mr. John Hastie, to whom we have pleasure in introducing our readers, is President of the British Columbia Construction & Engineering Company, general contractors, Victoria, B.C. As announced in the Contracts Department of our issue of February 25, Mr. Hastie's firm was recently awarded the contract for the departmental store to be erected at Victoria by the Hudson's Bay Company. Under the direction of Mr. Hastie many important operations have



Mr. John Hastie, Vancouver.

been carried out by the company. The buildings erected during the last two years include the Union Club Building, the Central Building, the Jones Building and the British Columbia Permanent Loan Building, aggregating an expenditure of one million dollars. The firm now have under construction the provincial gaol for the British Columbia government and the new Pantages theatre, the former being estimated to cost \$250,000 and the latter \$150,000. Mr.

Hastie is a native of Huron County, Ontario. He went west a quarter of a century ago and has been engaged continuously in contracting and building operations.

Mr. John Laing Weller, Chief Engineer of the Welland Canal—the progress, design and construction of which were the subject of an article in our last issue—was born at Cobourg, Ont., fifty-two years ago. Graduating from the Royal Military College, Kingston, he was appointed Assistant En-



Mr. J. L. Weller, M. Can. Soc. C.E., Chief Engineer Welland Canal System.

gineer on the Trent Canal in 1883 and on the Murray Canal in 1885. From 1888 to 1900 he was Principal Assistant Engineer on the St. Lawrence Canals and from 1900 to 1912 Superintending Engineer on the Welland Canal. In the latter year he was appointed to his present post of Engineer-in-Charge of the Survey, Design and Construction of the Welland Ship Canal. Mr. Weller's professional experiences have been of a responsible and varied character. At the time of the disastrous break in the Cornwall Canal Bank, in 1908, it was he who was placed in charge of the repairs. That he has not specialized in canal work to the exclusion of everything else is evidenced by the fact that he was the original inventor of reinforced concrete poles for electric lines. Apart from that he has had a distinguished military career. In the Northwest Rebellion of 1885 he served as a lieutenant in the Midland Battalion and became Staff Adjutant at the Base under Major-General J. W. Laurie. Later he was promoted Captain and Adjutant of the 59th Stormont and Glengarry Regiment. He retired when Senior Major. In 1885 he married Madelein M., daughter of J. J. Whitehead, Kingston, Ont. He has a family of one son and two daughters.

Sir Thomas Tait, whose name is mentioned in connection with the High Commissionership of Canada, is well known in railway circles in the Dominion. He was a prominent figure as one of the Victoria railway commissioners in Australia some years ago.

Mr. Frank Ditchfield, formerly general superintendent of the Canadian Car and Foundry Company, Limited, has been appointed to the staff of the Mechanical Engineering Company, Limited, of Montreal. He will direct the affairs of the company's consulting engineering department.

Dr. Parks, of the University of Toronto, lectured on "Canadian Marbles" before the Canadian Institute of Civil Engineers on March 8. He was convinced that the future of the marble industry in Ontario would be determined by the extent to which colored marbles were quarried.

Canadian Railroad Development

A contract is reported to have been let for commencing the construction of the Duluth to Fort William and Port Arthur railway.

An application by the Canadian Pacific Railway to construct a large tunnel in Glacier Park, near Rogers Pass, B.C., has been granted by the Dominion Government. The tunnel will be bored through the Beaver Mouth and Rose Creek, a distance of about fourteen miles.

The Hydro-electric Radial field-day convention passed resolutions at London, Ont., on March 5 calling upon the Dominion Government to assist the hydro railway scheme to the extent of \$6,400 a mile, and requesting that the plans for furthering the deep waterways projects be favorably acted upon.

The members of the Canadian Mining Institute while holding their sixteenth annual meeting at Montreal recently were conducted through the Mount Royal tunnel by Mr. S. P. Brown, chief engineer of the Canadian Northern Railway, and Dr. J. Austen Bancroft, Professor of Geology at McGill University.

According to a statement made by the Premier of British Columbia the Peace River line of railway as far as Parsnip River might eventually become the first section of the line through Northern British Columbia, the Yukon and Alaska. The average cost of the Pacific Great Eastern Railway is said to be over \$58,000 per mile, which brings the total cost to about \$27,840,000.

Mr. T. E. Wilkie, engineer-in-charge of the work, states that both of the Toronto Suburban Railway's extensions to Guelph and Woodbridge will be in operation this summer. On the line to Guelph about 98 p.c. of the grading has been completed between that city and the present terminus at Lambton Mills. Of the 46 miles of track on this road yet to be laid only about 1½ miles of grading remain to be completed in the neighborhood of Cooksville.

A culvert under a 170-ft. fill was recently completed on the Columbia Western Railroad about 30 miles west of Robson, B.C., where a high trestle on the Cascade Tunnel grade has been filled in. The crossing is in a narrow canyon, and it was considered cheapest to sluice the fill material from the adjacent hills by the use of hydraulic giants. The culvert, which is about 500 ft. long, was built up of masonry and has an arched roof with a span of about 12 ft.

Messrs. Dartnell, Limited, announce that Mr. W. H. Evans, C.E., has joined their sales staff. Mr. Evans comes direct from Toch Bros., New York City, where he has had a number of years experience in selling technical paints and waterproofing materials. Besides having a thorough knowledge of technical points, Mr. Evans is a practical waterproofing engineer. The Dartnell people look for a great increase in their R. I. W. and Toxement business following this appointment.

Sir Richard McBride, Premier of British Columbia, in a speech before the legislature recently, expressed the view that the time had now come for building a railroad through northern British Columbia to the Yukon and Alaska, the authorities at Washington and Ottawa having gone so far as to endorse some project of co-operation in the construction of this line. The Premier said that the project was too expensive for the province to take up single-handed, but that it lay within the power of Washington and Ottawa to approach and secure its completion within the next five years.

The Toronto Terminals Railway Company had its organization meeting recently, at which directors were elected.

The new company has a capital of \$2,000,000, the Grand Trunk and Canadian Pacific railways each owning a half interest. It is understood that revised plans for the Union Depot are almost completed and will be presented to the railway commission for ratification immediately. Contracts for the station will then be let and work on the \$15,000,000 project of station and viaduct will proceed.

Of the larger contracts pending, a prominent place must be given to the construction on the western irrigation work of the Canadian Pacific Railway, for which tenders are now being called by Mr. A. S. Dawson, Chief Engineer, Calgary, Alta. The work includes the timber structures in about half the area of the eastern section of the company's irrigation block in Alberta. The approximate quantities given are, 3,550,000 ft. B.M. of timber and 18,000 cu. yds. of excavation. All materials are to be furnished by the railway company.

The firm of Norton, Callard & Company, with offices at No. 4 Hospital Street, Montreal, were registered recently. For seventeen years, Mr. Norton was private secretary to Mr. Charles R. Hosmer, and Mr. Callard was with Messrs. James W. Pyke & Company for eleven years and Purchasing Agent with Canadian Allis-Chalmers, Limited, for three years. They represent Joseph Cookson, Limited, of Manchester, England, manufacturers of cotton waste, wipers, ropes, twines and flags, and J. H. Gautier & Company, of Jersey City, manufacturers of crucibles and gas retorts.

The new viaduct for the Canadian Northern Railway spanning the Black Canyon on the Thompson river a few miles below Ascroft, B.C., is reported to be nearing completion. From an engineering standpoint this bridge was one of the most difficult pieces of work in connection with the British Columbia mainland right-of-way. The structure had to be erected without the aid of false work and the fact that the line enters a 1,300-foot tunnel made the problem somewhat difficult to solve. An abutment was built on the tunnel's side and the massive steel girders were placed in position by means of a huge derrick which swung over the gorge. The main span is 210 feet long, and the total length 245 feet. The bridge is built of truss girders.

The Canadian Society of Civil Engineers have memorialized the Federal Government to appoint a commission to consist of a railway engineer, hydraulic engineer, railway manager, lawyer, transportation manager, two business men (one from the east and the other from the west), and a secretary, with the object of making recommendations on the general subject of improving rivers, lakes and waterways. With regard to railways the enquiry would be directed to defining what is the reasonable relation between earnings and expenses, to improve the Atlantic, Pacific and interior terminals, and also the Hudson Bay route. The memorial is prompted by the view that the early completion of the Panama Canal and the great developments of all lines of industry will raise questions calling for more than ordinary methods of solution.

The reports of the experts who have been engaged by the Government to report on the possibility of the construction of a bridge across the St. John river below Gage Town, for the St. John Valley Railway, have been tabled in the New Brunswick legislature by Premier Flemming. The experts were Mr. C. H. Monsarat, chief engineer of the Quebec Bridge board, and the Foundation Company, Limited, of Montreal. Both agreed that it was a practical proposition to build a bridge across the river at what is known as Dunham's Wharf site, which was one of three suggested. The cost of the entire structure, with equipment, is estimated by Mr. Monsarat at \$2,063,756, while that of the Foundation Company, who undertook to build the substructure, was \$1,395,000. The latter estimate however did not specify for ice

breakers on each of the small piers which it is proposed to have placed 80 feet apart; these if placed would cost about \$90,000, the difference in the two estimates.

A Special Blast Hole Cable Drill

WITH the growth of the rock-crushing business both as a commercial proposition and in conjunction with the industries, the use of the steam shovel became introduced more widely and the economy of big-hole blasting became a practical proposition. This feature of quarrying was introduced first in an experimental way in some of the largest crusher quarries and has rapidly grown to be an indispensable practice with those who find the need of moving rock at the minimum cost. The big-hole blast is more efficient in parallel lines with the size or dimensions of the operations, and bounded by the desired capacity of the crusher output.

To take care of the requirements of the particular features of big-hole drilling in crushed rock quarries there were adaptations necessary to be introduced to perfect the known types of drilling machines already in existence at the time of the beginning of the interest in the matter, and now with practical perfection in the machine itself to do the drilling, big-hole blasting is an indispensable feature in every quarry of large production. First, it economizes the cost of drilling in the total amount of the year's appropriations for such purposes; it economizes in dynamite, for the reason that with a deeper hole and the larger volume of explosive the last bit of its efficiency is brought into use and none of it is exploded idly in the air above the blast hole, as is the case in shallow and small holes.

It is more economical for the reason that the amount of rock moved from the quarry face will give the steam shovels a longer period of work in one "set," and again the blast can be made more efficient because it becomes an important part of the operations worthy of the attention of the superintendent to so place his holes as to give well calculated results, so that known results from a given amount of dynamite can be put into every calculation.

The cable drill system of drilling was first introduced into quarries for the purpose of drilling blast holes in or around the year 1902, and while it was not accepted generally at that time, the larger operators are now beginning to appreciate the advantages offered in this system of drilling; and we might say that ninety per cent. of the cable drills used in blast hole work up to the present date have been purchased within the last three to four years' time.

Water well drills of the cable type have heretofore been used almost exclusively for this purpose and the Armstrong Manufacturing Company, Waterloo, Ia., working on the theory that the action of the tools that would generate the highest efficiency in a water well drill designed for drilling through soft materials and in "wet holes" could not be applied successfully to a cable drill designed for exclusive rock drilling, experimented with a view to building an equipment which would insure faster cutting abilities and at the same time build a machine to conform to the heavier equipment required in quarry operating.

Cable drilling machines as applied to quarry work must necessarily be a different type of machine than those used for water well purposes, insofar as the general construction is concerned, and must be made considerably heavier, as the abuse which equipment of this kind is subjected to in blast hole drilling is much greater in a continuous run of, say, two months than water well drilling equipment would be subjected to in the course of two years. Therefore, every part of the machine was designed as a unit to insure the highest efficiency and to conform to the requirements of that class of trade.

Industrial Notes

Mr. W. Millar has been appointed Canadian manager of George Anderson and Company of Canada, Limited, Montreal, makers of stone-cutting machinery, cranes, derricks, gas engines, and gas suction plants.

The Southern Alberta Land Company, Limited, of Medicine Hat, Alta., are about to let the contracts for ditching portions of their irrigation scheme, involving some 700,000 cu. yds. of earth. In addition the company will do a large amount of concrete work, including the construction of reinforced-concrete headgates for two reservoirs, one of 300,000 acre-feet, the other of 30,000 acre-feet capacity. Mr. D. W. Hays is Chief Engineer.

Mr. Arthur E. Foulds has just opened a sales office in the Canadian Bank of Commerce Building, Brantford, Ont., as manufacturers' sales agent. He will carry a line of building materials, specialties and contractors' equipment. The experience with building supplies which Mr. Foulds has already had places him in a position to give good service, he having been for the past ten years on the executive staff of the Schultz Bros. Company, large contractors, of Brantford.

From the Canadian agents, Messrs. H. A. Drury Company, Limited, Montreal, we have received a copy of the Steel Sheet Piling Catalogue of the Lackawana Steel Company. The merits of steel piling are pretty generally recognized, but the booklet serves to illustrate the wide range of the application of the material in constructional practice. In a comparison of steel and wooden piling it is pointed out that steel is usually better even on comparatively easy work because it provides every strength element of tongue and grooved wooden piling and a joint-strength that is entirely absent with wood, while the increased transverse strength greatly reduces the amount of bracing required.

Canadian Allis-Chalmers, Limited, Toronto, have been appointed exclusive agents for Canada and Newfoundland of the Avery Automatic Scales. The parent factory at Birmingham, Eng., was established almost 200 years ago, and is without doubt the oldest and largest scale company in the world, comprising factories in England employing 5,000, and another at North Milwaukee, Wis. These scales are of the utmost value in power plant installation for checking the amount of coal and water feed to boilers, in weighing liquids for sugar and oil and other industries, and for use in cement plants to determine automatically the proper proportions of the various ingredients. The automatic grain scale is a recognized feature of every modern elevator and mill. The Avery Scale in the Canadian Government Elevator at Port Colborne constitutes the largest installation and the largest automatic grain scale in the world.

The Pneumatic Concrete Placing Company of Canada, have opened an office in the Transportation Building, Montreal, under the management of Mr. George W. Smith. The methods of the company for mixing and placing concrete through a pipe by use of compressed air are in favour in the United States. The ingredients are dumped into a conical steel shell and forced through an 8 in. pipe by air under pressure. The concrete is thoroughly mixed, and in practice has been placed at a distance of 1,100 feet and raised to an elevation of 80 feet above the mixer. Several plants are in operation in the United States, while the method has also been used at Niagara Falls, Ont., in the extension of the power house of the Ontario Power Company. The concrete lining of the Mount Royal tunnel of the C. N. R., Montreal, is to be placed in this manner. A large amount of concrete work is being done in Canada, and any process which will reduce the cost of the jobs, consequent on the small amount of labour and equipment, is of interest to engineers and contractors. The patent rights of the machine are held by the Pneumatic Concrete Placing Company of Canada.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Bedford, Que.

The Municipality of Bedford is about to purchase road machinery.

Belleville, Ont.

Tenders will be received by Dr. E. O. Platt, 1 Catharine St., until 6 p.m. March 23, for the excavation of pavements, approximately 18,000 sq. yds. The plans are at the city hall.

Brome, Que.

A committee comprising the Mayor and Councillors Bullard and Benham, has been appointed to purchase a road roller and sprinkler.

Chippewa, Ont.

The County Council has given a grant of \$2,500 toward the construction of one mile of macadam road through the village.

Calgary, Alta.

Tenders will be received by J. M. Miller, Clerk to the City Council, until 5 p.m. March 25, for 150,000 ft. sewer pipe and segment blocks. Specifications are at the office of the City Engineer, City Hall.

Dundas, Ont.

With reference to the proposed construction of sewers and sewage disposal plant a committee comprising Ald. W. H. Moss, Chairman, Reeve C. Collins, Deputy Reeve John Douglas, Ald. Harry Aucald and Ald. C. E. Dickson, has been appointed to choose an engineer and have plans prepared.

Edmonton, Alta.

Tenders will be received by the City Commrs. until noon March 31, for approximately 275,000 sq. yds. of street and lane paving with curbs and gutter. Specifications, etc., are at the office of the City Engineer.

London, Ont.

The purchase of waterworks supplies is being considered by the City Council, and tenders will be called in May for the supply of 4 in., 6 in., 8 in., 10 in. and 12 in. cast iron pipe and 100 hydrants.

Medicine Hat, Alta.

The laying of sidewalks at an estimated cost of \$110,000 is being considered by the city council.

Moore Twp., Ont.

The council has decided to repair a number of drains in the spring.

Ottawa, Ont.

Tenders will be received by the Chairman of the Board of Control until March 31st, for the supply of vitrified clay pipe.

Preston, Ont.

The town council will shortly call for tenders for the supply of sewer pipe.

Saskatoon, Sask.

Tenders will be received by the city

commissioners until April 10th for 19,500 lin. ft. sewer pipe, sizes 5-in. to 24-in. inclusive; 460 junctions and bends in sizes 8-in. to 24-in. inclusive. Specifications are at the office of the city engineer.

Smithville, Ont.

H. Gracey is considering the purchase of a crusher for macadam road making. About ten cords per day is expected to be the capacity.

Strathroy, Ont.

Plans are to be drawn for the laying of cement pavement, 24 ft. wide, and cement curb on Main St.

Swift Current, Sask.

Tenders will be received by Geo. D. Arnott, Clerk to the City Council, until 5 p.m. April 13th, for the supply of the following water pipe: 246 tons cast iron pipe; 7 tons cost iron pipe; 12,000 lin. ft., 6 in. steel pipe; 1,000 lin. ft., 8 in. steel pipe; 200 lin. ft., 10 in. steel pipe; 8 specials of various sizes; 44 6 in. gate valves and boxes; 8 8 in. gate valves and boxes; 20 fire hydrants. Forms of tender can be had at the office of the engineer.

St. Catharines, Ont.

Tenders will be received by the Chairman of the Board of Works, City Hall, until noon April 1st, for the construction of vitrified tile sewers on Western Hill, Westchester, Henrietta, McDonald, Dexter, Victoria, Ambrose, Rebecca, Permillia and Haines St. Estimated cost \$30,000. Plans are at the office of the Engineer.

St. Hermenegilde, Que.

The town has just secured funds from the Government to build 19½ miles of macadam roadway.

St. Thomas, Ont.

Tenders will be received by the City Engineer, M. Ferguson, until March 25, for a road oil sprinkler and 40,000 imperial gallons road oil.

Sault Ste. Marie, Ont.

The municipal council propose to expend the sum of \$30,000 on street extensions.

Toronto, Ont.

The Commr. of Works recommends the following sewer work: Sunnyside Drainage System, estimated cost \$8,960; Glenmanor Drainage System No. 1, estimated cost \$29,850; tile pipe sewer on Poplar Plains road, \$1,780.

The grading of Neville Park Blvd. has been approved by the Board of Control at an estimated cost of \$8,355.

The following pavement and grading has been recommended by the Commissioner of Works, R. C. Harris, at the cost specified: 42 ft. brick block on Leslie street, \$10,481; 40 ft. grading, Conduit St., \$13,021; 5 ft. concrete walk, Broadway Ave., \$2,295.

The Commissioner of Works recommends that a subway be built instead

of bridge on Main street, East Toronto. Estimated cost \$207,750.

New water mains are to be laid on following streets: Strathmore Blvd., Bathgate Ave., Lindsmore Cres., Greenwood Ave., Bridge St., Hope Ave., Williamson Rd., total cost \$4,735.

Victoria, B.C.

Tenders will be received by the Purchasing Agent, W. Galt, City Hall, until April 13th, for a semi-portable asphalt plant.

Windsor, Ont.

Tenders will be received by Euclide Jacques until noon, March 31st, for the supply of (a) 450 tons cast iron pipe, 100 tons Tees and 20 crosses; (b) 8 8 in. valves, 35 6 in. valves, 50 extension valve boxes; (c) 75 fire hydrants; (d) 10 tons pig lead.

Windsor Mills, Que.

The town council has asked the Provincial Government for a loan for the purpose of macadamizing certain roads.

Welland, Ont.

The Welland County Council has decided to build 34 miles of roadway by contract at an estimated cost of from \$150,000 to \$200,000.

Winnipeg, Man.

Tenders will be received by the Board of Control until March 20th for the erection of two pump houses at wells No. 20, 21 and 24.

CONTRACTS AWARDED

Hamilton, Ont.

The following contracts for municipal supplies have been awarded by the Board of Control. Cement, Alfred Rogers, 28 King St. W., Toronto, \$1.35 per bbl. Hydrants, Can. Allis-Chalmers, King St. W., Toronto, \$49 each. Castings, Hamilton Foundry Co., Clinton and Ruth Sts., \$1.85 per cwt. Iron pipe, Gartshore Thomson Co. Lead pipe, Tallman Brass Co. Creosote Block, McCoy & Brislin Co., Toronto.

Point Edward, Ont.

The following contracts have been awarded by the town council. Steel pipe, Page-Hersey Iron Tube & Lead Co., Ltd., Welland. Hydrants, Canadian Fairbanks-Morse Co., Ltd., 26 Front St. W., Toronto. Service Fittings, Mueller Mfg. Co., River Rd., Sarnia. Laying pipe, McGee & McGee, Point Edward.

Sudbury, Ont.

The town council has let the contract for sidewalks to Wilson, Townsend & Sanders, Toronto, \$7,461.35.

Toronto, Ont.

The following contracts for sewer construction have been awarded by the Board of Control; Commissioner of Works, R. C. Harris: Danforth Ave., \$21,300; Keele St., \$3,000; Melgund Rd., \$270; Osler Ave., \$480; Walmsley Blvd., \$620; general contractors, Wallace Construction Co., 405 Manning Ave. Hills-

view Ave., \$652; W. R. Hunter, Gillard R. Hunter, Gillard Ave., \$2,374; Rowland Ave., \$2,374; Rowland Ave., \$756; M. H. Murphy, 84 Dominion street, Kimberley Ave., \$2,081; Osborne Ave., \$2,146; Wayland Ave., \$2,084.

The contract awarded to the Commr. of Works, R. C. Harris, for the following asphalt pavements: Danforth Ave., from Greenwood to Roseheath \$47,156, Roseheath to Westlake \$44,400, Westlake to East City Limits \$41,821; Gerard St., from Greenwood to Coxwell \$19,811, Coxwell to Woodbine \$28,114, Woodbine to Main \$26,467; Spadina Ave. from Queen to Baldwin \$29,578. Total \$237,347.

A contract for the construction of the following sewers has been awarded by the Board of Control to Connolly Agnew Constr. Co., 606 Avenue Road: Evelyn Ave., \$3,470; Fairview Ave., \$2,857; Grace Terrace, \$1,080; Kennedy Ave., \$4,139; Laws St., \$2,035; Moore Ave., \$2,632; Pleasant Ave., \$4,880; Quebec Ave., \$2,836; Rosehill, \$3,339; Rosepark, \$3,664; St. Clair Ave., \$3,516.

The following contracts for sewers has been transferred from the Commr. of Works to Grant Contracting Co., 50 Front St. E.: Rhodes Ave., \$13,400; McRoberts Ave., \$6,810.

The following contracts for sewers have been awarded by the Board of Control. Grant Contracting Co., 50 Front St. E., Glendennan Ave., \$5,408; Jennings Ave., \$550. National Contracting Co., 9 Garnock Ave., Hannaford St., \$18,000. David Arnot, Ft. of Berkeley St., Heath St., \$3,428; Lyall Ave., \$2,876.

Winnipeg, Man.

The following contracts have been awarded in connection with the extensions to the water pipe line. Canadian Steel Pipe Co., Ltd., Winnipeg, for supply of 24,000 lin. ft., 36 in. steel pipe, at \$4.90, including bends, 40 manholes and flanged connections, 40 at \$40. each, flanged for valve connections, 10 at \$90 each, flanged branches, 12 in. off 36 in. 2 at \$50 each, 18 in. off 36 in., 1 at \$50, flanged air valve connection, 10 at \$15 each, 2 bends. Hurst Engineering & Constr. Co., Ltd., Winnipeg, for laying 36 in. steel pipe line from well No. 10, to McPhillips St. Reservoir, \$51,720.

A contract has been awarded by the Board of Control to J. W. Astley, Engineer of Construction, for the erection of two pump houses for wells No. 22 and 23 at \$3,500.

Railroads, Bridges and Wharves

Ayr, Ont.

The addition of another span of steel construction to Piper St. bridge is being considered by the town council.

Brampton, Ont.

The construction of a bridge at Main St. is being considered by the Town Council.

Brome, Que.

An application has been made to the Government for a grant to aid in the construction of a steel bridge.

Calgary, Alta.

The following plans and specifications have been submitted to the city council: For Centre St. Bridge: reinforced concrete bridge, 900 ft. long at \$274,600, or

reinforced concrete bridge, 900 ft. long at \$361,300; or reinforced concrete bridge, 900 ft. long, at \$237,600. For Louise bridge, Ninth Ave W.: reinforced concrete bridge, 600 ft. long, at \$167,000, or widening present steel bridge by a duplicate span at \$65,000. For Mission Bridge: reinforced concrete, 46 ft. roadway with two 8-ft. sidewalks at \$77,600, or a steel lattice girder with an ornamental railing, 46 ft. roadway with two 8-ft. sidewalks at \$67,000.

Camrose, Alta.

Tenders for extensions to the waterworks and sewers will be received by the Commr. and Engineer, S. Appleton. The work includes a sewage pumping plant to handle 3,000 gals. per day; 3,000 ft. 8 in. vitrified sewer pipe; 50 6 in. to 8 in. junctions; septic tanks, 10 x 10 x 20, 4,000 ft. 6 in. cast iron standard water pipe; also manhole covers, tees, sleeves, valves, centrifugal pumps, one 3-phase, 220 volt, 60-cycle motor, etc.

Fitzroy Twp., Ont.

The township council will receive tenders until March 24th, for 2 steel bridges with concrete piers and 1 concrete arch bridge over Mississippi River. Plans are at the office of the Clerk, A. Murphy, Antrim, Ont.

Gagetown, N.B.

The construction of a bridge over the St. John River is being considered by the Public Works Dept. A report has been submitted by C. H. Monsarrat, Chief Engineer, Quebec Bridge Board, and The Foundations Co., Ltd., Montreal. The estimated cost of the project is \$1,827,392.

Leamington, Ont.

After being interviewed by a deputation, the Minister of Public Works, Hon. Robt. Rogers promised to include the sum of \$100,000 in the estimates for improvements of the harbor.

Moncton, N.B.

The Public Works Dept. is preparing plans for a steel bridge to replace the present wooden structure across Petcodiac River.

Moore Twp., Ont.

Plans are to be drawn and tenders called for the construction of a new bridge of concrete and steel construction over Bear Creek as soon as possible.

Prince Rupert, B.C.

The construction of a concrete or steel bridge is being considered by the Municipal Council. Estimated cost \$100,000.

North Regina, Sask.

Plans for a railway depot, estimated to cost \$20,000, have been drawn by the Grand Trunk Pacific Railway Company.

Ottawa, Ont.

The St. Lawrence and Ottawa Electric Rly. Co., will probably apply shortly for a plebiscite to allow the railway to enter the city, cross streets, etc. The Nepean spur is to be finished as far as Connaught Park by August, 1914.

Quebec, Que.

The plans are about ready for the Transcontinental Railway station and tenders will probably be called in about two weeks.

Richmond, Que.

The town council, Sec., E. F. Cleve-

land, will receive tenders until March 26th, for replanking "Mackenzie" bridge.

St. Joseph de Alma, Que.

Tenders for the construction of an aqueduct, plans for which are with the Engineer-in-charge, J. A. Clareaux, Chicoutimi, will be called in about a month's time. Water is to be brought a distance of 12 miles.

Ste. Martine, Que.

Tenders will be received by the Sec. Municipal Council, for the construction of a 250 ft. steel bridge, over Chateauguay River.

Toronto, Ont., Thistletown

Tenders will be called shortly by the Etobicoke Township, for a steel and concrete bridge over Fourth Line. Estimated cost \$3,900. Engineer, Frank Barber, 57 Adelaide St. E.

Toronto, Ont. (Newmarket)

The town council has under consideration the construction of the town line bridge, 100 ft. span, estimated cost \$5,000, and Prospect Ave. bridge, estimated cost \$2,000.

Vancouver, B.C.

Tenders on the viaducts on Hastings, Pender, Keefer and Harris streets have been received from the following: The Robt. McLean Co., 744 Hastings St. W.: Hastings, \$82,000; Pender, \$53,700; Keefer, \$53,900; Harris, \$58,500. Jno. Galt Construction Co., Hastings, \$139,478; Pender, \$97,147; Keefer, \$95,428; Harris, \$100,430. Ledingham & Cooper, \$357,516; Union Construction Co., \$299,930; D. K. Campbell and W. Greenlees, \$367,712; Jas. McDiarmid Co., \$363,870; W. J. Smith Ltd., \$322,420; the Bentley Co., Ltd., \$359,458; Canadian Ferro Concrete Co., \$315,430; B. C. Granitoid & Contracting Co., \$345,661; Booker, Campbell & Whipple, \$348,444; Baynes & Horie, for Hastings only, \$149,420; Hodgson, King & McPhalen Bros., for Hastings only, \$124,245. All the tenders have been referred to the bridge engineers.

CONTRACTS AWARDED

Brantford Twp., Ont.

The following contracts have been awarded by the Twp. Council in connection with the construction of the bridge over Fairchild's Creek. Abutments, Howard Vanderlip, Cainsville, Ont., \$1,768. Steel work, Hamilton Steel Constr. Co., Lottridge St., Hamilton, \$2,250.

Burlington Channel, Ont.

The contract for the renewal of the south pier has been awarded by the Public Works Dept., to McKay, Paulin Construction Co., Ltd., Hamilton, Ont.

Dover Twp., Ont.

The contract for the construction of 11 bridges has been awarded by the Twp. Council to Jas. E. Doyle, Cross Street, Chatham, \$11,000.

Fredericton, N.B.

A contract for bridge construction has been awarded by the Public Works Department to Dom. Bridge Co., La- chine, Que.

Grand Falls, N.B.

The contract for bridge construction has been awarded by the Public Works Department to Dom. Bridge Co., La- chine, Que.

Gananoque, Ont.

The contract for the construction of

the wharf and approaches has been awarded by the Public Works Department to Sims, Robinson & Bingham, Ottawa, Ont., \$11,998.

Newcastle, N.B.

The contract for the construction of the bridge over Miramichi River, has been awarded by the Public Works Department to Dom. Bridge Co., Lachine, Que.

North Timiskaming, Que.

The substructure bridge contract has been awarded by the Public Works Department to Lynch, Beckham & Gorman, Portage du Fort, Que.

Osgoode Twp., Ont.

The bridge contract has been awarded by the Twp. Council to D. B. Cameron, Finch, Ont., \$2,400.

St. John, N.B.

A contract for pile and concrete wall construction has been awarded by the City Council to Geo. Michael, Brunswick St.

St. Prime, Que.

The aqueduct contract has been awarded by the municipal council to M. Aubin, St. Prime.

Toronto, Ont.

The lowest tender for the construction of the retaining walls and dock at the Don River, was \$171,000, submitted by the Harbor Commissioners Engineering Dept.

Public Buildings, Churches, Schools, etc.

Berlin, Ont.

Tenders for the erection of a 3-storey college of brick construction for the Lutheran Theological Seminary, will be received by McPhie, Kelly & Darling, Bank of Hamilton Bldg., Hamilton, until March 24th.

Burnaby, B.C.

Tenders will be called shortly for the erection of a 8-room school building on Vancouver Heights. The estimated cost is \$80,000, and J. H. Bowman, Yorkshire Bldg., Seymour St., Vancouver, is the architect.

Edmonton, Alta.

Plans have been drawn for temporary school at Glenora and Cromdale subdivisions.

Plans are to be prepared for a club building in connection with the McDougall Methodist Church. The estimated cost is \$100,000 and Mr. Moorehouse, of the Jackson Block, will probably be the architect.

A new church is contemplated by the Windsor Park Methodist Church Congregation. Further information can be had from Dr. Riddell, Alberta College, or R. H. M. Bailey, 7 Main St. N.

Improvements to King Edward School are contemplated by the Public School Board, and plans are being drawn by Mr. Turner, architect to the board, for a 17-room building of brick and stone construction.

North Edmonton, Alta.

Plans for a 4-room addition to the school have been drawn by Mr. Turner, architect to the Public School Board.

South Edmonton, Alta.

Plans have been drawn for two tem-

porary schools to be erected near the University.

Plans for an 8-room addition to the Rutherford school have been drawn.

Galt, Ont.

The Public Works Department has plans in progress for the erection of the new drill hall.

Glencoe, Ont.

The village council has petitioned the Carnegie Trust Fund for the sum of \$5,000 for the erection of a public library.

Halifax, N.S.

Extensions, estimated to cost \$20,000 or \$30,000, are planned by the St. Marys Y. M. T. A. & B. Society, Barrington St.

Funds are to be raised for the erection of a gymnasium in connection with the Dalhousie University, Carleton Street. The following committee has been appointed: J. S. Fraser, W. M. Nelson, H. P. Bell, F. D. Graham, J. McG. Stewart.

Plans are being drawn for a hall and club house for the St. Joseph's Catholic Total Abstinence & Benevolent Society. Tenders will be called by W. J. Busch, architect, 60 Bedford Rd., Halifax, up to March 31st.

Hamilton, Ont.

Tenders for the erection of the Ryerson Methodist Church, on Main St. E., will be received by McPhie, Kelly and Darling, Bank of Hamilton Bldg., until March 24th.

Hespeler, Ont.

The erection of a public library is being considered by the town council.

Lindsay, Ont.

The erection of an isolation hospital is being considered by the town council and funds are now being raised.

East London, Ont.

The city council has decided to abandon the question of the proposed market building.

Lennoxville, Que.

The town council proposes to call for tenders for the new fire station and stables as soon as plans are prepared.

Macleod, Alta.

Tenders for the erection of a school building for the Parkerville School Dist. will be received by the Sec., F. Faulkes, until March 25th. Plans, specifications, etc., at the office of "The Spectator," Macleod.

Malton, Ont.

A site has been purchased here by the Roman Catholic Church authorities who will erect orphanage buildings, at an estimated cost of \$100,000.

Medicine Hat, Alta.

A site for a temporary church on Highland and 8th Ave. has been purchased by the Westminster Presbyterian Church congregation. Architect, N. T. Williams, Main Street.

Plans for a 6-storey business block, to cost \$225,000, have been drawn for E. D. Bennet, Toronto St., by A. Dickinson, architect, 22 Hull Block.

Plans for extension to the city hall, estimated to cost \$15,000, are being drawn by McCoy & Levine, architects, Hooper and Huckvale Block.

Moncton, N.B.

Plans are being prepared for a church building for the French R. C. Denomina-

tion by R. A. Frechet, architect. A suitable site is being looked for.

The St. John's Presbyterian Church Congregation have the erection of a new church and parsonage under consideration and options on suitable sites are being secured.

The city council proposes to erect a new city hall at a cost of \$40,000, to replace the building recently destroyed by fire, the ruins of which are now being cleared away.

Montreal, Que.

Plans are being drawn for the erection of a clubhouse on Cherrier St., for the National Amateur Athletic Assn. The estimated cost is \$250,000.

The erection of an assembly hall, on Dorchester St. W., for St. Patrick's Parish is being considered.

Tenders for the erection of a church building for the Parish of St. Eusebe de Verecil, will be called by Beaugrand Champagne & Chenevert, architects, 182 St. Catherine St. E., about May 1st.

Plans are in progress for the erection of a presbytery for St. Michael's Parish. Beaugrand Champagne & Chenevert, architects, 182 St. Catherine St. E., Montreal, will call for tenders April 1st.

Niagara Falls, Ont.

Plans for the erection of a conservatory have been drawn for the Queen Victoria Niagara Falls Park Commission. The building, which is estimated to cost \$200,000, may be built in sections.

Plans for addition to Barker St. School are being drawn by C. M. Borter, architect, Niagara Falls South.

North Battleford, Sask.

Tenders for interior fittings at the post office will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until April 8th. Plans at the office of Stephenson, Evans & Fillingham, architects; W. T. Mollard, Clerk of Works; and at the Dept., Ottawa.

Nelson, B.C.

The construction of a garbage incinerator is being considered by the Municipal Council.

Ottawa, Ont.

Separate tenders for school addition at Hopewell Ave., to cost \$85,000, will be received by the Public School Board until March 24th.

New plumbing is required throughout Cambridge St. School, and tenders will be called shortly.

Certain additions are being considered by the Ottawa Collegiate Board.

Fire Chief Graham has advised the Board of Control that the Central Fire Station is in an absolutely dangerous condition. A new station will likely be built.

Pt. Elgin, Ont.

The remodelling of the Presbyterian Church is being considered.

Point Grey, B.C.

Tenders for the erection of the university buildings for the Education Department, will be called about April 1. Architects, Sharpe & Thompson, London Bldg., Vancouver.

Port Coquitlam, B.C.

Plans have been prepared for a Central school, to cost \$18,000, and tenders will

be called shortly. Architect, T. H. Bamforth, 319 Pender W., Vancouver.

Regina, Sask.

The erection of a moose temple at a cost of \$20,000, is being considered by the Moose Temple Co., Banner Bldg.

A temporary frame church has been erected for the Presbyterian Church Congregation, of which Rev. E. Blae, 1209 Laird St., is pastor, pending the erection of the new church.

Rogersville, N.B.

A site has been donated for the erection of a R. C. Church at Collet Ridge.

St. John, N.B.

H. C. Mott, architect, 13 Germain St., is drawing plans for a new public school on Douglas Ave. Estimated cost \$50,000.

An executive committee has been appointed to go into matter of rebuilding the Salvation Army hall recently destroyed by fire. A campaign is to be started in about two weeks time to raise the necessary fund of \$30,000.

Shediac, N.B.

R. A. Frechet, architect, Moncton, is about to draw plans for a R. C. Church, work upon which is expected to start this summer.

Stoney Creek, Ont.

Plans for a new parish hall for the Church of the Redeemer are being drawn by F. W. Warren, architect, Bank of Hamilton Bldg., Hamilton, Ont.

Summerland, B.C.

Plans for the erection of a \$6,000 hospital building are being prepared for the Hospital Board.

Summerside, P.E.I.

Tenders for the construction of a 3 or 4 target steel rifle range, will be received by the Director of Contracts, Militia Headquarters, Ottawa, until noon March 23rd. Plans, etc., at office of the Officer Commanding 6th Division, Halifax, N.S., the Town Clerk, Summerside, and the Director-General of Engineer Services, Headquarters, Ottawa.

Sydney, C.B.

Tentative plans have been filed with Chairman of the Board of Education for a technical school building, 2 stys., 140 x 135, to accommodate about 1,000 pupils, and an assembly hall to seat 600. Architect, Prof. F. H. Sexton.

St. Hyacinthe, Que.

Plans are being drawn for the proposed "Girouard" academy, by McDuff & Lemieux, architects, 364 University St., Montreal.

St. Joseph, N.B.

The erection of a chapel for St. Joseph's University will be proceeded with immediately.

Toronto, Ont.

Plans for additions to the Deacons Emanuels Presbyterian Church have been approved and work will be started shortly.

The Advisory Committee of the Board of Education is considering a site in the east end for a branch of the Technical School.

The Hope Methodist Church congregation propose to raise funds for the erection of a Sunday school building.

The erection of a school on Evelyn St., is being considered by the Separate

School Board, who have purchased a site in Ward 7.

Wrecking on the site for the new registry office on Albert and Chestnut Sts., is about to start, and the architect, C. S. Cobb, 71 Bay St., has been instructed to prepare working plans at once.

The following incinerators are recommended by the Commr. of Works, R. C. Harris. One located at Western Cattle Market Annex Building for old furnaces at Western Cattle Market, \$6,560; repairs to furnaces, \$7,000; new buildings, \$10,472; furnaces, \$17,500. Eastern Yards—buildings, \$10,472; furnaces, \$22,500. Total, \$74,504.

Toronto, Ont., Long Branch

Tenders will be received until March 28th, addressed to the Director of Contracts, Militia Headquarters, Ottawa, for the construction of a rifle range. Plans, etc., are at the office of 2nd Dist., Simcoe St., Toronto, and Director-General of Engineer Service, Headquarters, Ottawa.

Toronto, Ont., Aurora

115 acres of land has been purchased east of Aurora, where a training school for the Christian Brothers will be established.

Thorndale, Ont.

Plans for a brick church for the St. Georges Episcopal Church congregation are being drawn by McBride & Gilbert, Dundas and Richmond streets, London.

Welland Jct., Ont.

Plans for a 4-room school, to cost \$14,000, have been drawn for the School Board, by C. M. Borter, architect, Niagara Falls South.

CONTRACTS AWARDED

Brantford, Ont., Echo Place

The contract for the erection of a Sunday school building for Elm Ave. Methodist Church, has been awarded to Nathaniel Kew, 97 Erie Ave.

Barrie, Ont.

The following sub-contracts have been awarded on the completion of the Collegiate Institute: Heating and plumbing, J. E. Farrell, North Bay; electrical fittings, Electric Light Commission. Architects, Stewart & Witton, 7 Hughson Street South, Hamilton.

South Edmonton, Alta.

The contract for heating and plumbing at the University of Alberta dormitory has been let to A. E. Hatton, 628 Leggett street.

Halifax, N.S.

The contract for extension to the residence of the Pine Hill Pres. Theological College, Franklyn St., has been awarded to Freeman Bros., 13½ Carleton Street.

The following contracts have been awarded in connection with the erection of the new St. Matthias Anglican Church, Windsor St. General contractors, masonry and carpentry, E. J. Horne & Son, 255 Agricola St. Heating, Farquhar Bros., Ltd., Barrington St. Excavating will be started about April 1st.

Kingston, Ont.

The following contracts have been awarded on the Regiopolis College: Excavating and masonry, McCartney & Payne, University Avenue; carpentry, Hunter & Harold, Queen St.; painting

and glazing, Robinson Bros., Bagot St. The other contracts are not yet awarded.

London, Ont.

The following sub-contracts have been awarded in connection with the erection of the Egerton Street Baptist Church: general contract, Hyatt Bros., Egerton St.; plastering, Walter Gould, East London; painting, Arthur E. Cook, Askin St.; tin work, Sutherland Bros., Dundas St.; stained glass, Hobbs Mfg. Co., Talbot St.; plumbing, Eggett & Co., King St.; wiring, People's Electric Co., 641 Dundas Street.

Milverton, Ont.

The contract for the public building, on Main St., has been awarded by the Public Works Department, to W. F. Martin, Gananoque.

Montreal, Que.

The following contracts have been awarded in connection with the erection of the R. C. school on the Mountain. General contractors, J. B. Gratton, Ltd., 82 Mercier St., at \$104,204. Heating, W. J. McGuire & Co., Ltd., 332 Craig St. W., at \$11,940.

The contract for the erection of the office building on St. James St., for the National Trust Co., Ltd., has been awarded to Norcross Bros. Co., New Birks Bldg.

Ottawa, Ont.

The contract for additions to the royal mint refinery has been awarded by the Public Works Department to Jos. Burke, Hull, Que.

The following contracts have been awarded in connection with the erection of the new Glebe Methodist Church. Architect, C. J. Burritt, 193 Sparks St. Mason, Alex. Garvock, 136 Lewis St. Carpentry, Alex. Christie, Elgin St. Roofing, J. D. Sanderson, 507 McLeod St. Sheet metal, McFarlane & Douglas, Slater St. Plastering, J. J. Greene, 17 Craig St. Painting, Geo. Higman & Son, Rideau St. Heating and plumbing, J. R. McLennan, Bank St. Electrical, H. P. Parks, 205 Laurier Ave. W. Tile, Ottawa Tile & Mosaic Co., 289 Laurier Ave. W. The contract for steel work is not yet let.

The contract for elevators and motors in the additions to St. Lukes Hospital, Elgin St., has been awarded to Otis-Fensom Elevator Co., Queen St.

Pembroke, Ont.

The contract for the erection of the armoury has been awarded by the Public Works Department to P. J. Beatty, Pembroke, who has sub-let the following: Concrete work, L. B. Lachance, 30 Melgund Ave., Ottawa. Carpenter, R. G. Reinke, Eganville.

Victoria, B.C.

The following contracts have been awarded in connection with the erection of the Quadra St. N. General contractors, Luney Bros., Ltd., Room 508, Sayward Bldg., \$46,500; heating and ventilating, R. J. Nott & Co., Ltd., 1046 Mason street, \$6,975.

Walsingham Twp., Ont.

The contract for the erection of the public school, for S. S. No. 15, North Walsingham, has been awarded to architect and general contractor, Geo. Jeffries, Lynedoch, Ont.

Business Buildings and Industrial Plants

Alliston, Ont.

The ratepayers have passed a by-law giving free site and water and fixed assessments, the Dominion Gas Traction Company will build a plant here.

Aylmer, Que.

Tenders will be called an early date for the erection of cow barns and dairy buildings, for the Silver Springs Dairy Farms, Ltd. Architect, C. P. Meredith, 126 Sparks St., Ottawa.

Brantford, Ont.

Plans are being prepared for the erection of 3-storey silk mill on Drummond and Sarah streets, by the Niagara Silk Mills Co., Buffalo, N.Y.

Brockville, Ont.

The Central Canada Coal Co. has had plans drawn for the erection of a coal elevator, estimated cost \$20,000.

Coaticook, Que.

The Neidner Co. of Malden, Mass., U.S.A., has been granted certain concessions by the town; a hose factory will be erected immediately.

Cobourg, Ont.

The council propose to grant bonus of \$10,000 to Messrs. John & Chas. Dick who are considering the erection of a felt factory.

Calgary, Alta.

A permit for a theatre, on 9th Ave. E., to cost \$35,000, has been granted to O. G. Devenish, Burns Block.

Collingwood, Ont.

The erection of a wood screw factory is being considered by the Imperial Steel & Wire Co., Ltd., it is understood that the bonds will be guaranteed by the ratepayers.

Copper Cliff, Ont.

Plans for a branch bank here are being drawn for the Bank of Toronto, by C. F. Martin, architect, Tyrell Bldg., Toronto, Ont.

Crediton, Ont.

Plans are in progress for a garage and repair shop for Albert Morlock, estimated cost \$7,000.

East Angus, Que.

The Brompton Pulp & Paper Co. proposes to erect a pulp mill here.

Edmonton, Alta.

Magoon & MacDonald, architects, Tegler Block, have drawn plans for a \$50,000 club and office building for Bell, Auld & Houston, 1459 Victoria Ave.

Tenders for the erection of stores and offices, on Jasper Ave., for Williamson Bros., are invited by E. W. Morehouse, architect, 26 Jackson Block.

Fort William, Ont.

The erection of a \$40,000 warehouse is being considered by Cameron & Heap Co., Hardisty St.

Tenders for the supplying of a stone crushing plant for Mount McKay Products, Ltd., are invited by F. Van Antwerp, 41 Murray Bldg., engineer-in-charge, until March 31st.

Hamilton, Ont.

W. W. LaChance, architect, 157 Main

St. W., is preparing plans for an arena and ice rink for Alerts, Ltd., Barton St. E., who are also considering the erection of 8 stores and apartments.

London, Ont.

Wallace Chapman, 812 Lorne Ave., has abandoned the idea of erecting a picture theatre.

Moncton, N.B.

A company in which R. C. Bacon, 21 Austin St., is interested, is being organized for the erection of an arena. The estimated cost of the building, for which a site has been chosen, is \$75,000.

The erection of a biscuit factory is contemplated by J. A. Marven, Ltd., 526 Main St. W. C. Barnes, architect, will probably draw plans.

Montreal, Que.

Tenders for the erection of a factory for Tuckett Tobacco Co., Ltd. are in and contracts will be awarded shortly.

Plans for a 2-storey factory for Fyon & Fyon, 288 Garnier St., have been drawn by Benoit & Girard, 215 St. Catherine W., who will call tenders for general contractor about April 1st.

Caron Bros., 233 Bleury St., have just purchased the property at the corner of Bleury and Concord Sts., and may erect large office building.

The erection of a manufacturing plant is being considered by J. S. Fry & Sons, Ltd. J. H. Collis, 27 St. Sacrement St., is the local manager.

Tenders for the erection of a bank and office building for the Bank of Toronto, are invited by Hogle & Davis, 80 St. Francois Xavier St.

Montreal, Que., Lachine

Tenders for the erection of an hotel for Hudon & Orsali, 259 St. Paul St., Montreal, are in, and a decision will be shortly made regarding the project.

Montreal, Que., Pointe Claire

The building of a club house for the Pointe Claire Boating Club, is postponed indefinitely.

Montreal, Que., Outremont

Plans for a warehouse and office, to cost \$10,000, have been drawn by Seaman-Kent, Ltd., Durocher St., Outremont, and tenders will be called immediately.

Niagara Falls, Ont.

Plans for the Niagara Linen Co. factory, are prepared; a temporary structure is to be erected at present, to be replaced later by a permanent building.

North Sydney, N.S.

M. J. McPherson will call tenders about May 1st, for the erection of a theatre building on Commercial St., estimated cost \$5,000.

Ottawa, Ont.

Nelson, Grayburn, et al., Bilings Bridge, contemplate constructing chutes at the C. N. R. tracks. Capacity 500 tons coal, 1,500 cords of wood.

Plans for addition and alterations to the stores and apartments of J. C. MacDonald, Albert St., have been drawn by Weeks & Burgess, Citizen Bldg.

J. Albert Ewart, 193 Sparks St., has drawn plans for a \$100,000 store and of-

fice building for Jackson Booth, Metcalfe St.

Tenders for the erection of a theatre, on Queen St., are invited by C. P. Meredith, architect, 126 Sparks St.

Port Hardy, B.C.

Plans are being prepared for the erection of store and residences for the Hardy Bay Trading Co., Ltd., 739 Hastings St. W., Vancouver.

Port Dover, Ont.

T. A. Ivery & Sons have drawn plans and will shortly start work on the erection of a 300 ft. x 50 ft. greenhouse.

Preston, Ont.

Plans are in progress for a store, bowling Alley and billiard room, to cost \$25,000, for C. E. Fischer, Waterloo, Ont. Tenders received by Ornan G. Scheifle, Waterloo, architect, after April 1st.

Regina, Sask.

A permit has been issued to The Constructors Ltd., 810 Dewdney Ave., for an office building to cost \$15,000.

Ruthven, Ont.

The question of the erection of a club house is occupying the attention of the Ruthven Gun Club, of which Orville Fox is secretary.

Sydney, C.B.

The erection of a civic cold storage plant is contemplated and the Board of Trade recommends application of a Federal subsidy. Plant will be for the use of fishermen and general storage.

St. Thomas, Ont.

Plans for the new Arlington Hotel, on Talbot St., have been drawn by Jno. T. Findlay, architect.

Sault Ste. Marie, Ont.

Tenders for the erection of stores and offices, corner Gore and Albert Sts., for Geo. Carnfel, are invited. Estimated cost \$40,000.

Sherbrooke, Que.

Plans for alterations and addition to the Wellington St. store of G. T. Delisle, have been drawn.

Stratford, Ont.

Plans for the Diebel furniture frame factory are being drawn by Thos. Hepburn, architect, Downie St., who also has plans in progress for the Morelock upholstery factory.

St. Andrews, N.B.

Plans for bank and office building for the Bank of Nova Scotia are being drawn by F. Neil Brodie, 42 Princess St., St. John.

Toronto, Ont.

W. J. S. Tremaine, 171 Keele Street, has frontage of 140 ft. on Roncesvalles Ave. and proposes to erect seven stores and apartments thereon.

Raymond Constr. Co., Ltd., 43 Victoria St., who have the contract for the Holbrook warehouse, are taking tenders now on roofing, plastering, painting, heating, plumbing, electrical and sheet metal work.

Plans for stores and residences, on College St., to cost \$15,000, have been drawn for R. E. McDonagh, 184 Spadina Ave.

Uxbridge, Ont.

The erection of a large rink, 200 ft. by

120 ft., is being considered by The Athletic Assn.

Victoria, B.C.

Preliminary sketches are being prepared for a rink for the Victoria Curling Club. The estimated cost is \$25,000 to \$30,000. Architects, Coates & Fleet, 28 Winch Bldg.

Windsor, Ont.

Sketches for a theatre and stores on Pitt Street East have been drawn for the Empress Theatre Co. by J. C. Pennington, architect, La Belle Bldg. Estimated cost \$100,000.

Winnipeg, Man.

Plans for a bakery on King St., to cost \$8,000, have been drawn for P. H. Lechtzner, 271 Dufferin.

Plans for addition to the plant of the Manitoba Cold Storage Co., Higgins Ave., have been drawn, and private tenders are being invited.

Woodstock, Ont.

The Woodstock Agricultural Society has 179 acres purchased in the East End for fair grounds. New buildings will be erected shortly.

CONTRACTS AWARDED

Merriton, Ont.

The contract for additions to the pulp mill of the Riordon Pulp & Paper Co., has been awarded to W. J. Trimble, 152 Bay St., Toronto.

Montreal, Que.

The following sub-contracts have been let on store alterations, etc., for the Canada Office Furniture Co., Notre Dame St. Heating and plumbing, Hickey & Aubut, 93 Dominion St. Electrical, F. X. Guillevin, 1088 St. James St.

The following sub-contracts on store alterations on Notre Dame W., for C. J. Fleet, K.C., St. James St., have been let. Roofing, Metal Shingle & Siding Co., Ltd., 91½ Delorimier St. Heating and plumbing, Jno. Watson & Co., 4145 St. Catherine St. Electrical Collyer & Brock, 131 St. Alexander. Four storeys, 93 x 39.

The contract for alterations to the stores of the Western Canada Flour Mills Co., 1240 Henri Julien, has been let to General contractors, Jas. Shearer Co., Ltd., 225 St. Patrick.

Ottawa, Ont.

The contract for the erection of a printing plant for the Lowe-Martin Co. has been awarded to Alex. Garvock, 136 Lewis street.

Red Deer, Alta.

The contract for the erection of the business block for Mr. Michener has been let to A. M. Boyle.

Sandwich, Ont.

The contract for the erection of the factory buildings for the Canadian Alkali Co., Ltd., has been let to Theo. Starrett Co., Free Press Bldg., Detroit, Mich.

Toronto, Ont.

The following sub-contracts have been awarded on the Greisman warehouse, at the corner of Richmond and Duncan Sts. Cement and stone, Cement Products, Ltd., St. Claire Ave., W. Elevators, Otis-Fensom Elevator Co., Ltd., 50 Bay St. Heating and plumbing, John Ritchie Plumbing & Heating Co., Ltd., 56 Adelaide St. E. Electrical and sprinkler

system, Bennett & Wright Co., 72 Queen St. E.

Residences

Knowlton, Que.

Plans are being drawn for summer residence, to cost \$10,000, for Wm. Scully, 320 University St., Montreal. Architect, Robt. Findlay, 10 Phillips Place, Montreal, who will call tenders about March 25th.

Lennoxville, Que.

The following propose building residences in the spring: Wm. Bown, D. G. Harrison, Wm. Parge, Thos. Harrison, John Wilcox and H. Banfil.

London, Ont.

Herbert Sutherland, 14 Evergreen Ave. proposes to erect a residence at an estimated cost of \$5,000.

Gordon Ingram, 493 Dufferin Ave., proposes to erect a residence on Wellington St., at a cost of \$12,000.

Hyatt Bros., Egerton St., East London, have plans in progress for the erection of residences on Ridout St., costing \$15,000.

D. McAlpine, 870 Wellington St., will probably erect a \$6,000 residence on Alma St.

Plans for the alterations of the residence to an apartment house, Queen Ave. E., are being prepared by J. Hayman & Son, Ltd., Wellington St.

Montreal, Que.

A permit for the erection of flats to cost \$5,000 has been issued to M. Patry, 94 Montgomery Street.

Plans for a residence, on Harvard St., for Dr. Globinsky, St. Catherine W. and Bleury, are being drawn by Benoit & Girard, 215 St. Catherine St. W., who will call for tenders about April 1st.

A permit has been issued to Albert Brouillet, 191 Marquette, for the erection of flats on Chabot St., to cost \$9,000.

The erection of a large apartment house, on Sherbrooke, is being considered by Montreal Agencies, Ltd., Sun Life Bldg.

Plans for an apartment house, on Marcell St., have been drawn by H. J. Gagne, 97 St. James St. Estimated cost \$16,000. No tenders will be called before May 1st.

Clients of Hutchison, Wood & Miller, architects, Royal Ins. Bldg., Montreal, are contemplating the erection of 20 residences at a total cost of \$80,000.

A permit for 6 flats on Labelle St., to cost \$8,000, has been issued to Jos. Art. Godin, 269 St. Denis.

Gauthier & Daoust, 180 St. James St., will invite tenders some time in April for the erection of a \$200,000 apartment house on Durocher St., for A. L. & J. A. Caron.

The erection of an apartment house on Stanley St., is contemplated by Jno. H. Hand, 609 Belmont St. Wright & Son, 204 St. James St., will be the architects.

Montreal, Que., Notre Dame de Grace

Putnam & McCrory, Merchants Bank Bldg., propose to erect six residences on Madison St.

Montreal, Que. (Notre Dame de Grace)

Plans for an apartment house on Har-

vard have been drawn for Jno. H. Hand, 609 Belmont St., who will invite tenders for roofing and electric shortly.

Montreal, Que., Westmount

A site has been purchased at the corner of Sherbrooke and Oliver Sts., by the Belgo-Canadian Realty Co. for the erection of an apartment house.

Montreal, Que., Outremont

Finley & Gagnon, New Birks Bldg., Montreal, is inviting tenders on a residence for Mr. E. P. Dame.

Oakville, Ont.

W. R. Greig, Middle Rd., proposes to erect a \$5,000 residence, and W. A. Dean, Colborne St., is inviting tenders until April 1st for a number of residences in Glendover Park Survey.

Ottawa, Ont.

The erection of an apartment block is being considered by C. Rupert, 37 5th Ave.

Quebec, Que.

Paul Cote, Marchand & St. Olivier streets, invite tenders on a 3-storey residence, estimated to cost \$5,000.

Regina Beach, Sask.

H. Y. Golinich, 2267 Cornwall St., Regina, is inviting tenders until March 30, on a 2-storey residence; estimated to cost \$5,000.

Regina, Sask.

J. S. Bartleman, 2138 McIntyre St., has purchased a site at the corner of Cornwal St. and 14th Ave., and proposes to erect a \$50,000 apartment block thereon.

Recent permits include: \$5,000 residence on Garnet St., for J. B. Louthier, 1324 Montague St.; \$5,000 residence on Atkinson St., for H. T. Lewis, 1326 15th Ave.; \$5,000 residence on Robinson St., for J. B. Foder, 16 Crescent Ave.

St. John, N.B.

Plans for a residence to cost \$10,000, for F. G. Spencer, Unique Theatre, Charlotte St., have been drawn by Garnet Wilson, 50 Princess St.

St. Catharines, Ont.

Joseph Daw, architect, 165 St. Paul St., is inviting tenders on a brick residence on Helena Ave.

The Pioneer Land & Building Co., Ltd., 79 Adelaide St. E., Toronto, Ont., has purchased a tract of land and is preparing to erect a number of 6 and 8 room houses.

Toronto, Ont.

W. J. S. Tremaine, 171 Keele St., has purchased a site on Janet street for the erection of a number of residences.

J. T. V. May, 22 Shannon St., has purchased a site having 168 ft. frontage, on Crawford St., and will erect residences. Estimated cost \$30,000.

Plans for 3 pair residences on Lansdowne Ave., have been drawn for Fried & Clark, 349 Indian Road.

Tenders for all trades on an apartment block, at the corner of Isabella and Sherbourne Sts., are invited by N. G. Beggs, Cosgrave Bldg.

Vancouver, B.C.

Plans for the erection of 5 residences on 13th and 14th Aves., have been drawn by Vernon Bros., 570 Granville St., who invite tenders on some trades. Five

other houses will be erected in the near future.

Walkerville, Ont.

Plans are being prepared for a double residence on Argyle Road for Capt. J. B. Forrest. Smith & Walker, architects, Excise Bldg., estimated cost \$6,000.

Woodstock, Ont.

Thos. D. Broom & Son, 18 Wilson St., will probably build a number of residences on George and Canterbury Sts.

The erection of a residence to cost \$6,000 to \$8,000 at the corner of George and Wellington Sts., is being considered by E. C. Thornton, Princess St.

Winnipeg, Man.

W. A. Cameron, 238 Arlington St., proposes to erect a \$11,000 residence on Grosvenor Ave.

Plans for a store and residence on Bannerman Ave. to cost \$7,500, have been drawn by Bray & Briston, 89 McAdam Ave.

CONTRACTS AWARDED

Montreal, Que.

The following contracts for the erection of an apartment house on St. Hubert and Johnston Sts., have been awarded. Stone, Wallace Sandstone Quarries, Ltd., Transportation Bldg. Brick, Webster & Sons, 31 Wellington St. Carpentry, Damien Lalonde, Ltd., 1000 Christophe Colombe St. Architect, Marius Dufresne, Ontario St., Maisonneuve, who is still taking tenders on all other trades.

The contract for the erection of the residence and garage for C. A. Barnard, K.C., 313 Stanley, has been awarded to general contractor, E. B. Evans, 357 St. Catherine W.

The following contract has been awarded on the residence of S. C. Skelton. Mason, carpentry and plastering, Wm. Irving, Guy Block. Architects, Turner & Carless, Board of Trade Bldg.

Montreal, Que. (Westmount)

The contract for the erection of a residence for G. A. Trenholme, Rosemount Ave., has been let to A. F. Byers, 340 University Ave. Sub-tenders on roofing are invited.

The following contracts have been awarded in connection with the erection of the residence of I. P. Rexford, on Montreal St.: Masonry, John Allan, 300 Atwater St.; carpentry, Wm. Irving, Guy Block; steel, Dominion Bridge Co., Lachine; roofing, Richardson Simard Co., 745 Clarke St.; plastering, Watson & Wilson, 1680 Hutchison St.; painting, Geo. Blackwell, 4184 St. Catherine St. W.; heating and plumbing, Selkirk Bros.; electrical, Archibald & Brotherhood, Herald Bldg. Architects, Turner & Carless, 116 Board of Trade Bldg.

Ottawa, Ont.

The contract for electrical fittings on the apartment building on Frank St. has been awarded to Seguin & Co., 369 Dalhousie St.

Regina, Sask.

Roger Edwards, 1667 Athol St., has secured the contract for the erection of the residence of A. Faunt, 207 Simpkins Block.

Sandwich, Ont.

The following contracts have been awarded on the residences on River front for R. M. Morton. Windsor. Architect, J. C. Pennington, Windsor; ma-

sonry and steel, John Ferguson, Windsor; carpentry, T. I. Brush, Windsor; roofing, Detroit Roofing & Tile Co., Detroit, Mich.; plastering, Kennedy & Son, Windsor; painting, T. W. Brooke & Son, Windsor; heating and plumbing, Windsor Hardware Co., Windsor; electrical, Gilbert Campeau, Windsor.

Toronto, Ont.

The following contracts have been awarded in connection with the erection of a residence on Strathgowan St. for G. M. Wright, 84 King St. E.: general contract, Palmer Bldg. & Contracting Co., 51 McKinnon Bldg.; carpentry, W. E. Wakelin, 184 Van Horne St.; plastering, Jas. Robertson, 615 Lansdowne Ave.; heating, Jos. Harrison, 8 St. Marys St.; plumbing, A. F. Passmore, 428 Yonge St.; electrical, J. P. Murphy, 29 Macdonnell street.

The contract for the erection of 4 pair residences on Balfour and Palmer Avenues, for Geo. C. Popham, 2337 Yonge St., has been let to Jas. Stanhope, 2287 Yonge St.

The following contracts on the erection of 2 cottages, stable and garage, on Snowdon St., for H. Acton Fleming, 149 Admiral Road, have been awarded. Plumbing, Read Franklin Co., 553 Bloor St. W. Electric wiring, E. F. W. Salisbury, 49 Wellington St. E. Hot air furnace, Pease Heating Co., 118 King St. E. Stable and cow stall fittings, Tisdale Iron Stable Fittings Co., 17 Temperance St.

Vancouver, B.C., Shaughnessy Heights

The contract for the residence of Jno. Cowdry, has been let to C. A. Hilchey, 4673 12th Ave. W.

Windsor, Ont.

The contracts for the erection of the bungalow on Ouelette St. for John Pageau have been awarded to: Masonry, Geo. Sewell; carpentry, Urgel Jacques; roofing, heating and plumbing, Jos. L'Heureux; plastering, F. W. Phillips; painting, T. W. Brooks & Son; electrical, Gilbert Campeau.

Yarmouth, N.S.

The contract for the erection of residences for Capt. G. W. Doty and Stanley M. Cain have been let to Porter & Allen.

Power Plants, Electricity and Telephones

Blenheim, Ont.

The town council propose either to enlarge the present electric plant or install the hydro-electric system.

Burford, Ont.

The ratepayers passed the by-law for the use of hydro power, also the by-law for the erection of a distributing station and equipment.

Grand Rapids, Sask.

Surveys are being made by J. G. Kerry, c/o Smith, Kerry & Chase, Toronto and Winnipeg, with a view to erecting a plant for the manufacture of electricity.

Guelph, Ont.

The Guelph Radial Rly. Co., Waterloo Ave., receive tenders until noon, March 23rd, for alterations to the power house.

Hull, Que.

The following railway extensions are proposed by the Hull Electric Railway: double tracking Laurier Ave., Youville

to Reboul streets and Reboul street to Brewery Creek, also the construction of a branch line to Notre Dame Cemetery.

Kinley, Sask.

Tenders for the construction of a telephone system will be received by Ed. Unworth, sec.-treas., to the Crocus Belle Rural Telephone Co. until March 30th.

London, Ont.

The following electrical apparatus and supplies are required by the City Council (Hydro Commis.): poles and cross arms for hydro lines, estimated cost \$25,000; meters, estimated cost \$10,000; cable and wire, estimated cost \$25,000; line transformers, \$30,000, and transformers and regulators for hydro-electric substation, estimated cost \$10,000.

Prince Rupert, B.C.

The municipal council is considering the possibility of hydro-electric lighting.

Port Coquitlam, B.C.

The Fire Commissioner has recommended the installation of an electric fire alarm system.

Regina, Sask.

Tenders will be received by Commr. L. A. Thornton, of the Light & Power Dept., until March 28th, for (1) station switchboard, consisting of 2 exciter panels, 6 generator panels, 1 totalling panel and 16 feeder panels; (2) six 3-phase feeder regulators; (3) 1 motor driven exciter 125 kw.; (4) 1 geared turbine driven exciter 125 kw. electric end speed not over 900 r.p.m. Specifications, etc., are at the office of the engineer.

St. Mary's, Ont.

The Hydro-electric Commission has recommended that the arc lights be replaced by 80 c.p. tungstens at an estimated cost of \$10,000.

Sherbrooke, Que.

B. A. Dugal, Sec. Elec. Dept., City Hall, will receive prices on 300 cedar poles, 30 ft. to 45 ft. long, f.o.b. cars Sherbrooke.

Swift Current, Sask.

Tenders will be received by the Engineer, G. D. Mackie, for the completion of the power house building.

Windsor, Ont.

The erection of a power building to cost \$80,000, is proposed by the Windsor Power Building Co.

CONTRACTS AWARDED

Ottawa, Ont.

A contract for motors and wiring has been awarded by the Ottawa Dairy Co., Somerset St., to B. H. Baldwin & Co., 52 Queen St.

St. John, N.B.

The contract for alterations to the telephone building has been awarded by the N. B. Telephone Co., to J. C. Berrie, 48 Princess street.

Saskatoon, Sask.

The following contracts have been awarded by the city council subject to the passage of by-law: Canadian General Elec. Co., Ltd., 40 Central Chambers, for 15 kw. transformers, friction tape, fuse wire (5 amps.) fuse wire (10, 20 and 30 amp.), cross arms and locust top pins; Western Electric Co., 406 3rd Ave. S., for wire and cable and poles; Ferranti, Ltd., 56 Albert St., Winnipeg, for meters.

(Continued on page 84)

Tenders and For Sale Department

Notice

CITY OF SWIFT CURRENT

Sealed tenders, endorsed on envelope "Tenders for Cast Iron Pipe," "Tenders for Steel Pipe" or "Tenders for Gate Valves and Hydrants," as the case may be, will be received by the undersigned up to 5 o'clock p.m. of Monday, April 13th, 1914, for the supply and delivery F.O.B. Swift Current, Sask.:

Contract "A-4"

246 Tons Cast Iron Pipe of various sizes.
7 Tons Cast Iron Pipe of Special Castings.

Alternative:

12000 lin. feet of 6-in. Steel Pipe.
1000 lin. feet of 8-in. Steel Pipe.
200 lin. feet of 10-in. Steel Pipe.
Specials of various sizes.

Contract "B-4"

44 6-in. Gate Valves and Boxes.
8 8-in. Gate Valves and Boxes.
20 Fire Hydrants.

Specifications and forms of tender may be obtained on application to the City Engineer, Swift Current.

A marked cheque for an amount equal to five per cent. of the contract is required as a deposit.

The lowest or any tender not necessarily accepted.

GEO. D. ARNOTT,

City Clerk.

Corporation Offices,
Swift Current, Feb. 28, 1914.

10-12

Tenders Wanted

Separate sealed tenders addressed to Euclide Jacques, Esq., Chairman, Water Commissioners, Windsor, Ont., and marked "Tender," will be received by the undersigned up to 12 o'clock noon, Wednesday, March 31st, 1914, for:

(a) 450 tons (more or less) of cast iron water pipe, size from 6-in. to 10-in.
100 tees, and 20 crosses.

According to standard specifications adopted by Canadian Society of Civil Engineers.

(b) 8 8-in. valves.
25 6-in. valves.
50 extension valve boxes, 5 ft. in length.

(c) 75 fire hydrants to bury 5 ft., having 6-in. barrel with two 2½-in. and one 4-in. steamer connection

(d) 10 tons pig lead.
All of above to be delivered f.o.b. cars Windsor.

All pipe must be tested to 300 lbs. before leaving the factory. A certificate of test must be furnished in accordance with the terms of Section 16. No outside weights will be accepted.

A certified cheque payable to the order of the Water Commissioners equal to 5 per cent. of the amount of the tender must accompany each tender, which cheque in the case of an unsuccessful tenderer will be forthwith returned, but in the case of the successful tenderer, will be retained until a satisfactory bond for the due performance of the work is executed, or if such successful tenderer for any reason neglects or refuses to execute a satisfactory bond within 15 days after notice that his tender has been accepted by the Water Commissioners, said cheque will be cashed, and the expense of re-advertising the work required, and any additional cost in connection with the same over the amount of his tender, will be retained from the proceeds of such cheque.

The right is reserved to reject any or all tenders.

THE WATER COMMISSIONERS.

W. A. Hanrahan, Secretary.

Windsor, Ont.
March 6th, 1914.

10-11



Department of Militia and Defence

Long Branch, Ont.—Rifle Range

Notice to Contractors

Sealed tenders marked on the envelope "Tender for addition to Rifle Range, Long Branch, Toronto, and addressed to the Director of Contracts, Militia Headquarters, Ottawa, will be received until noon, the 28th March, instant, for certain additions to the Rifle Range at Long Branch, Toronto.

Plans and specifications may be seen and full information obtained at the offices of the Officer Commanding the 2nd Division, Toronto, and the Director General of Engineer Services, Headquarters, Ottawa.

Tenders must be made on forms supplied by the Department, and each tender must be accompanied by an accepted cheque on a Canadian Chartered Bank, for ten per cent. (10 p.c.) of the amount thereof, payable to the order of the Honourable the Minister of Militia and Defence, which amount will be forfeited if the party tendering declines to enter into the contract or if the successful tenderer fails to complete his contract in accordance with the tender.

The Department does not bind itself to accept the lowest or any tender.

EUGENE FISET, Colonel,

Deputy Minister.

Department of Militia and Defence,
Ottawa, March 6, 1914.

Newspapers will not be paid if this advertisement is inserted without authority from the Department.
H.Q. 18-35-14—57164. 11-12



Sealed tenders addressed to the undersigned and endorsed "Tender for Addition and Alteration to Public Building, Smith's Falls, Ont., will be received at this office until 4 p.m., on Monday, March 25, 1914, for the work mentioned.

Plans, specification and form of contract can be seen and form of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Smith's Falls, Ont., and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,

Secretary.

Department of Public Works,
Ottawa, March 3, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—53010. 10-11

TOWN OF HUMBOLDT

PROVINCE OF SASKATCHEWAN

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer until 8 p.m., Wednesday, April 15th, for the following works:—

Contract "A"—Labor Laying Water Mains and Sewers.

Contract "B"—Pump House and Filter House.
Contract "C"—Furnishing Material for, and Erecting Water Towers.

Contract "D"—Furnishing Cast Iron Water Pipes.
Contract "E"—Furnishing Fire Hydrants and Valves.

Contract "F"—Furnishing and Installing Pressure Filters.

Contract "G"—Furnishing and Installing Pumping Machinery.

Contract "N"—Furnishing wood Stave Pipe.

Contract "O"—Laying Wood Stave Pipe.

Contract "P"—Constructing Ejector Station.

Contract "S"—Furnishing Sewer Pipes.

Contract "X"—Constructing Sewage Disposal Works.

Plans and specifications may be seen at the office of the Engineers, Toronto and Winnipeg, and at the Town Hall, Humboldt, on and after March 16th.

No tender necessarily accepted.

W. H. STILES, Esq., Sec.-Treasurer,

O. W. ANDREASEN, Esq., Mayor,

CHIPMAN & POWER, Engineers. 9-11



Tenders

Tenders addressed to the undersigned at Ottawa and marked on the envelope "Tender for Illuminating Oil and Oil for Kerosene Engines," will be received up to noon of the Twenty-eighth day of March, 1914, for the supplying and delivering about 150,000 gallons of Illuminating Oil and about 50,000 gallons of Oil for Kerosene engines, both made according to the specifications prepared by the Department of Marine and Fisheries.

The quantities mentioned herein are only estimates and the Department reserves the right to order larger or smaller quantities as required.

Specifications and forms of tender can be procured from the Collectors of Customs at Toronto, Petrolia and Sarnia, and from the Agents of this Department at Montreal, Quebec, St. John, Halifax and Charlottetown, and also from the Purchasing and Contract Agent, Marine Department, Ottawa.

Each tender must be accompanied by a deposit cheque equal to five per cent. of the total amount of the tender.

All tenders must be made on the tender form prepared by the Department.

No tender will be considered except for oil strictly in accordance with the specifications and put up in packages as called for in said specifications. Samples of the oils, cans and cases must be submitted.

The Department reserves the right to accept the whole or any part of a tender.

The lowest or any tender not necessarily accepted.

Newspapers copying this advertisement without authority will not be paid for same.

A. JOHNSTON,

Deputy Minister of Marine and Fisheries
Department of Marine and Fisheries,

—56784. Ottawa, 16th February, 1914. 10-12

TOWN OF OUTREMONT

Street Lighting Standards

Notice to Contractors

Tenders are hereby invited for the supply and delivery at the Corporation Yard, Outremont, of: 450 street lighting standards, with globes, reflectors, insulators and sockets and accessories complete. Price to be given per standard, including delivery. Specifications and drawing can be obtained from the Town Engineer's office, Town Hall, Outremont.

A certified cheque for \$1,000 payable to the order of the undersigned must accompany tender.

Tenders must be received by the undersigned at the Town Hall, Outremont, on or before Wednesday, 1st April, 1914, at six p.m. Tenders will be opened by the Council in the presence of the parties interested at the Town Hall, Outremont, on Wednesday, 1st of April, 1914, at eight p.m.

The Council does not bind itself to accept the lowest or any tender.

E. T. SAMPSON,
Secretary-Treasurer.

11



Notice to Contractors

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, up to noon on **Tuesday, March 31st, 1914**, for the construction of the following sewers, viz.:

Durie Ave., Annette St. to Bloor Street.
Gerrard St., Wayland Ave. to Victoria Park Ave.
Gilbert Ave., Norman Ave. to north city limit.
Gilmour Ave., Annette St. to Woodside Ave.
Innes Ave., McRoberts Ave. to Gilbert Ave.
Kent Road, Queen Street to north end.
Kingswood Ave., Queen St. to Kingston Road.
Lincoln Ave., Gilmour Ave. to west end.
Midway District Drainage Scheme Outlet from Cannon Ave. and Gerrard St. to south outlet of Maughan Cres. and Hemlock Ave. via Cannon Ave., Cairns Ave. and Hemlock Ave.
Midway District Drainage Scheme Outlet from Cairns Ave. and Hemlock Ave. to Bowmore Rd. and Fairmount Cres. via Cairns Ave., Pullan Ave., Wrenson Rd. and Bowmore Rd.
Morton Rd. N., Danforth Ave. to south end.
Norman Ave., McRoberts Ave. to G. T. R.
Poplar Plains Cres., Poplar Plains Rd. to Rathnally Ave.
Scarborough Rd., Queen St. to Kingston Rd.
Silver Birch Ave., Queen St. to Kingston Rd.
Sorauren Ave. Storm Overflow Sewer Sec. No. 2, from Sorauren Ave. and Columbus St. to Dundas St. and Golden Ave. via Columbus St., Lane first west of Sorauren Ave., Lane first south of Dundas St., Lane first east of Parkway Ave., Lane first south of Dundas St., Lynd Ave. and Dundas Street.
Stevenson Ave., Morton Road to Main Street.
West Lake Ave., G. T. R. to Danforth Ave.
Willard Ave., Bloor St. to Annette Street.
Windermere Ave., Bloor St. to Annette Street.

Envelopes containing tenders must be plainly marked on the outside as to contents.

Specifications may be seen, and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Tenderers shall submit with their tender the names of two sureties (approved of by the City Treasurer, not members of the City Council, or officers of the Corporation of the City of Toronto) or, in lieu of said sureties, the bond of a Guarantee Company, approved of as aforesaid.

The usual conditions relating to tendering as prescribed by City by-law must be strictly complied with.

The lowest or any tender not necessarily accepted.

H. C. HOCKEN, Mayor,
Chairman, Board of Control.

Toronto, March 13th, 1914. 11

Tenders

for

Bridge Construction

Sealed tenders plainly marked as to contents will be received by the undersigned up to noon of **Friday, April 3rd, 1914**, for the construction of a concrete arch bridge, 50 ft. span, on Dawes Road in the County of York, known as the Massey Bridge.

Plans, specifications and all necessary information may be seen at the office of Frank Barber, C.E., 57 Adelaide Street East, Toronto.

The lowest or any tender not necessarily accepted.

FRANK BARBER,
County Engineer.

Toronto, March 17, 1914. 11

CITY OF SASKATOON

Tenders

for

Sewer Pipe and Specials

Sealed tenders, addressed to the City Commissioners, Saskatoon, and endorsed "Tender for Sewer Pipe and Specials," will be received up till noon on **Friday, the tenth day of April, 1914**, for the supplying of the following materials:—

19,500 lineal feet of Sewer Pipe in sizes 5-in. to 24-in. inclusive.
460 Junctions and Bends in sizes 8-in. to 24-in. inclusive.
The Corporation reserves the right to reject any or all tenders.

All information may be obtained on application to Junius Jonsson, Acting City Engineer.

F. E. HARRISON, Mayor,
Chairman of Commissioners.
Saskatoon, March 9th, 1914. 11-12



Sealed tenders addressed to the undersigned and endorsed "Tender for Public Building, Newmarket, Ont.," will be received at this office until 4 p.m., on **Monday, March 30, 1914**, for the work mentioned.

Plans, specification and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge St., Toronto, at the Post Office, Newmarket, and at this Department.

Persons tendering are notified that tenders will not be considered unless made on the printed forms supplied, and signed with their actual signatures, stating their occupations and places of residence. In the case of firms, the actual signature, the nature of the occupation, and place of residence of each member of the firm must be given.

Each tender must be accompanied by an accepted cheque on a chartered bank payable to the order of the Honourable the Minister of Public Works, equal to ten per cent. (10 p.c.) of the amount of the tender, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS,
Secretary.

Department of Public Works,
Ottawa, March 5, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—50788. 10-11

For Sale

One standard gauge locomotive in operating condition. Cylinders 24 in. x 18 in.

The Jenckes Machine Company, Ltd.,
6-19 Sherbrooke, Que.

Tenders Wanted

Tenders will be received by the undersigned for a Hospital Building at Walkerville, Ont., until **March 27th, 1914**. Plans may be seen at the office of Smith & Walker, Walkerville, or at the offices of the undersigned. The lowest or any tender not necessarily accepted.

LANGLEY & HOWLAND, Architects,
112 King St. West, Toronto.

Tenders Wanted

Sealed tenders addressed to the undersigned will be received up to **Wednesday, March 25th**, for the supply of:—

1—Approximately 40,000 Imperial gallons Road Oil.

2—Road Oil Sprinkler.

Full particulars may be had from the City Engineer.

M. FERGUSON,
City Engineer.

St. Thomas, March 7, 1914. 10-11

Church Tenders

Sealed tenders, separate or in bulk, will be received by the undersigned until 6 p.m. on **Tuesday, the 31st inst.** for all trades (except heating) required in the erection of St. Francis Church, Grace Street and Mansfield Avenue, Toronto. The successful contractors will be required to give satisfactory bonds. The lowest or any tender not necessarily accepted.

ARTHUR W. HOLMES, Architect,
10 Bloor St. East, Toronto, Ont.

11-12

Asphalt Plant

Sealed tenders will be received up to 4 p.m., **Monday, April 13, 1914**, for a semi-portable asphalt plant for the Corporation of the city of Victoria, B.C. Specifications may be secured from W. Galt, City Purchasing Agent, to whom all tenders must be addressed and marked "Tender" on outside of envelope. The lowest or any tender not necessarily accepted.

11-13

City of Calgary

Sealed tenders, addressed to the City Commissioners, and marked "Tender for sewer pipe and segment blocks," will be received at the office of the City Clerk, up to 5 p.m. of **Wednesday, March 25th, 1914**, for the supply and delivery f.o.b. Victoria Park, Calgary, and as required by the City from time to time, of approximately 150,000 feet of sewer pipe and segment blocks.

Particulars, information and specifications may be obtained from the office of the City Engineer, City Hall, Calgary.

A marked cheque in the amount of five per cent. of the total amount of bid, payable to the City of Calgary, must accompany each tender. Cheques will be returned to unsuccessful tenderers so soon as a contract has been executed.

The City reserves the right to accept or reject any or all tenders in whole or in part or to accept any bid or portion thereof as may be advantageous and to the satisfaction of the City.

J. M. MILLER, City Clerk.

11

Church Tenders

Bulk and separate tenders will be received by the undersigned up to **Wednesday noon, March 25th**, for the several trades in connection with the erection of the Presbyterian Church of St. David's, Harvie Ave., Toronto.

HERBERT G. PAULL, Architect,
11 395 College St., Toronto, Ont.

Tenders Wanted

Tenders will be received by the Council of the Township of Hullett up to 3 p.m. on **Friday, March 27th, 1914**, for the digging and construction of the Bowes Award Drain in the Townships of Hullett and Morris.

Plans and specifications can be seen at the Township Clerk's Office, Londesboro, Ont.

The lowest or any tender not necessarily accepted.

JAMES CAMPBELL,
10-11 Township Clerk.

Tenders Wanted

Tenders wanted from all trades for the erection of a four-room brick school building for school section No. 4 Humberstone. Plans and specifications may be had on and after **March 12** at Mr. Chas. Ort's, Welland Junction, or at the office of the Architect, C. M. Borter, 102 Main Street, Niagara Falls, Ont. Tenders to be handed into the Secretary of the School Board, Mr. Chas. Ort, or at the office of the Architect before 6 p.m., **March 27th, 1914**.

The School Board reserves the right to reject any or all tenders. 10-12

Wanted Employees

Engineering Sales Representatives wanted in Canada by large United States firm manufacturing sewerage disposal apparatus and other sewerage specialties. Apply Box 992, Contract Record, Toronto. 11-12

Bargains in Rebuilt Machinery, Located at Milwaukee, Wis.

Trench Machines

- 2 Parsons Trench Machines, cut trench from 27-in to 60-in. wide and 20 ft. deep.
- 1 No. 0 Municipal Trench Machine, with gasoline power.
- 1 No. 1 Municipal Trench Machine, with steam engine and boiler.
- 1 No. 3 Municipal Trench Machine, with steam engine and boiler.
- 1 Buckeye Trench Machine, cuts trench 24 in. to 27 in. wide and 7½ ft. deep.
- 1 Buckeye Trench Machine, cuts trench 27 in. to 30 in. wide and 10 ft. deep.
- 1 Buckeye Trench Machine, cuts trench 24 in. and 36 in. wide and 12 ft. in depth.

Steam Shovels

- 1 45-Ton Vulcan Steam Shovel, mounted on railway wheels, 3 sets of engines.
- 1 25-Ton Vulcan Shovel, full circle, No. 1620, mounted on traction wheels.
- 1 30-Ton Little Giant Traction Shovel, 3 sets of engines, mounted on traction wheels.
- 1 No. 0 Thew Shovel full circle, mounted on traction wheels.

Miscellaneous

- 1 J. I. Case 10-Ton Road Roller.
- 2 50 Horse Power J. I. Case Hauling Engine.
- 1 25 Horse Power Reeves & Company Hauling Engine.
- 1 Lidgerwood Hoisting engine, 7 x 10, D.C.D.D., with boom swinger and boiler.
- 1 20 Horse Power Fairbanks-Morse Gasoline Engine, mounted on trucks.

Write us for prices and specifications.

Cream City Equipment Company,
400 Majestic Bldg.,
Milwaukee, Wisconsin.

10-12

Wanted Employment

Construction Engineer with eight years' experience in designing and construction of bridges and reinforced concrete building desires to secure position. Excellent references. Box 991, Contract Record & Engineering Review, Toronto. 11 12

Opportunity

We own a medium sized plant for manufacturing panel and switchboards, including machinery, dies, stock templates, cost data, half tone illustrations, etc. Owing to our Contracting Business interfering with manufacturing we will dispose of this plant for cash at a great sacrifice. Inasmuch as the far greater percentage of panel boards used in Canada are now imported from the States, and carry a duty of 27½ per cent., an exceedingly profitable business can be built up by a wide awake man who is in a position to take this plant over and operate it in Canada. Address Box 929 Contract Record, Toronto. 53-12

Equipment Wanted Second Hand

Dump Cars, 1 yd. and 2 yds.
Clam Shell Derrick Hoist, for excavating sewers and sand pits.
Dump Wagons.
Lackawanna or U. S. Steel sheet piling.

GODSON CONTRACTING CO.,
113 Manning Chambers,

11-12 Toronto, Ont.

(Continued from page 81)

Miscellaneous

Edmonton, Alta.

The city council has decided to put a wire netting 3 ft. high along the top of the railing on the High Level Bridge at a cost of \$6,000.

Hull, Que.

The city council proposes to purchase fire escapes for Hull Court House.

Medicine Hat, Alta.

The city council are about to purchase two combination hose and chemical motor-driven fire trucks.

Ottawa, Ont.

M. M. O'Connell, 212 Gloucester St., wishes prices on brick, cement, lumber, hardware, electrical goods, paint, telephones, electric bells, etc., for thirty apartments now in course of erection.

Toronto, Ont.

The car ferry contract has been awarded by the Ontario Car Ferry Co., Cobourg, Ont., to Polson Iron Works, Ltd., Frederick St., Toronto.

Tofield, Alta.

Extension to the gas system at a cost of \$14,000 are contemplated by the town council.

Windsor Mills, Que.

The installation of a fire alarm system is under consideration by the fire committee.

CONTRACTS AWARDED

Edmonton, Alta.

The contractor for the gas system near Viking of the Edmonton Industrial Association is the International Supply Co.,

Medicine Hat. Minimum depth, 1,700 ft.; maximum 2,300 ft., at \$16.50 per ft.

Gravenhurst, Ont.

Rock and Power Machinery Co., Toronto, has been awarded the contract for supplying complete rock crushing plant to the Gravenhurst Crushed Granite Co. The plant will include two No. 6 and one No. 8 Kennedy Gyratory Crushers. Also a 75-foot Kennedy Elevator, Rock Drills, and FJAB steel.

Ottawa, Ont.

A contract for submarine cables for Prince Edward Island has been awarded by the Public Works Department to Siemens Co. of Canada, Ltd., Transportation Bldg., Montreal.

Point Anne, Ont.

The Point Anne Quarries have awarded the contract to Rock and Power Machinery Ltd., Toronto, for a special Kennedy revolving screen.

Saskatoon, Sask.

The following contracts have been awarded by the city council subject to the passage of the by-law, J. H. Ashdowne Hardware Co., Ltd., First Ave. N. for assorted files, white lead, stillson and monkey wrenches, brass valves, padlocks, steel octagon and steel round tools. Jas. Robertson Co., Ltd., 176 Pacific Ave., Winnipeg, for 112,000 lbs. of lead pipe. Saskatoon Hardware Co., Ltd., 2nd and 22nd streets, for hacksaw blades, oil cans, red lead, emery and sand paper, metallic and linen tapes, cut washers and irons. Canadian Fairbanks-Morse Co., Ltd., 8-10 23rd street east, for couplings, elbows, tees, unions, bolts and bulk iron pipe.

St. John, N.B.

The contract for the supply of lumber has been awarded by the city council to Thos. Bell Lumber Co., Princess St.

Toronto, Ont.

Rock and Power Machinery Limited, has been awarded a contract by the Ontario Stone Corporation for a No. 6 Kennedy Crusher, elevators, screens, etc.

Welland, Ont.

The contract for the year's supply of stone has been awarded to Standard Crushed Stone Co., Niagara Falls, Ont.

Winnipeg, Man.

The following contract has been awarded by the Board of Control: Standard Underground Cable Co. of Canada, Ltd., 1002 Electric Railway Chambers, for 20,000 lbs. No. 4 B & S weatherproof insulated, triple braid stranded copper wire at \$18.78 per lb., 10,000 lbs. No. 8 B & S weatherproofed double braid, solid copper wire at \$18.53 per lb.

Business Notes

Acme, Alta.

The store and restaurant occupied by Randall & Brown, and Long Pai has been damaged by fire to the extent of \$15,000.

Chaplin, Sask.

The store of Wells & Parker and Hindson & Thurstell's drug store have been destroyed by fire; estimated loss \$17,000.

Dorval, Que.

The store and residence of Mr. A. Guillett, 19 St. Joseph St., has been

(Continued on page 86)

“Inglis” Corliss Engines

are known above all others as being pre-eminently “Engines of Quality,” Economical, Durable and Reliable and can be depended upon to give the same good results twenty years from now.

We build them Single, Tandem, Compound and Triple, for heavy or light duty. Remember our Fifty year reputation is back of every “INGLIS” engine. Specifications and prices upon request.

The John Inglis Company

ENGINEERS AND BOILERMAKERS

Limited

14 Strachan Ave.,

Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

damaged by fire; the loss, \$5,000, is covered by insurance.

Eastview, Ont.

The residence of Alderic Leger, Montreal Rd., has been destroyed by fire; loss \$6,000.

Gadsby, Alta.

A fire involving a loss of \$58,000 occurred at the Oxford Hotel and adjacent buildings.

Lumsden, Sask.

An explosion at the Lumsden Electric Light Co. damaged the plant to the extent of \$7,000.

Moncton, N.B.

A disastrous fire here inflicted the following losses: City Hall bldg., \$60,000; Marven & Magee (biscuit manfrs.), loss \$7,000; First Baptist Church, loss \$5,000; public library, loss \$5,000; City Office, loss \$5,000; Armstrong & McFarlane, \$3,000; Roy D. Biggar, \$3,000.

Montreal, Que.

A serious fire at the cork and spice factory of S. H. Ewing & Sons, 98 King St., resulted in the total destruction of the plant.

New Glasgow, N.S.

The brick plant of the Standard Clay Products has been destroyed by fire; loss \$60,000.

Omeme, Ont.

The armory building has been completely destroyed by fire; loss \$10,000.

Ottawa, Ont.

The store and residence of Kalil & Abraham, 648 Somerset, has been des-

troys by fire; the loss, \$8,000, was partially covered by insurance.

North Timiskaming, Que.

M. W. Charboneau's general store, residence and pool room has been destroyed by fire; loss \$8,000.

St. Jerome, Que.

The sawmill of Jos. Bouchard has been damaged by fire to the extent of \$5,000.

St. Vincent de Paul, Que.

A bad fire destroyed Catholic Chapel, Hospital, stores department and offices of the St. Vincent de Paul Penitentiary; loss \$100,000.

Toronto, Ont.

A disastrous fire in the factory section inflicted the following losses: A. L. Rudd, 785 King St. W., loss, stock, machinery and building, \$65,000; insurance, \$50,000; Robert Crean Co. (hat factory) 783 King W., loss, stock and building, \$50,000; insurance \$40,000.

Windsor, Ont.

The Central Hotel has been damaged by fire; loss \$16,000. All furnishings were practically destroyed and the owner, A. Pillon, will rebuild.

New Companies

Port Arthur Construction Co., Ltd., has been incorporated with a capital of \$500,000, with head office at Port Arthur, Ont. The provisional directors are A. J. Thomson and W. S. Morlock, solicitors, of Toronto.

Canadian Engineering and Contracting Co., Ltd., has been incorporated with

a capital of \$100,000, with head office at Hamilton, Ont. The provisional directors are J. J. MacKay, F. W. Pauline and F. A. Magee, all of Hamilton.

Canadian Metal Products, Ltd., has been incorporated with a capital of \$100,000, with head office at Guelph, Ont. The provisional directors are C. L. Dunbar, T. Tatham, James Sutherland and J. Sutherland, Jr., all of Guelph.

The Glendyne Slate and Roofing Company, Limited, has been incorporated with a capital of \$100,000, with head office at Richmond, Que. The provisional directors are S. McMorine and J. McMorine, merchants, Richmond, Que., S. H. Fraser and E. O. Davies, slate manufacturers, of New Rockland, Que.

Kingston Iron and Tube Co., Ltd., has been incorporated with a capital of \$1,000,000, with head office at Kingston, Ont. The provisional directors are J. E. Dey and J. M. Ferguson, of Toronto.

The Mineral Springs Sand and Gravel Co., Ltd., has been incorporated with a capital of \$40,000, with head office at Hamilton, Ont. The provisional directors are J. L. Sibbald, R. R. Bruce and J. L. Counsell, all of Hamilton.

Arthur L. Weeks

Architect

Canada Life Building, Ottawa

Reinforced concrete and steel structures, factories and commercial buildings

BITUNAMEL

Unsurpassed for waterproofing foundations and preventing rust and corrosion on exposed iron and metal work.

WRITE FOR SAMPLE

The Ault & Wiborg Co. of Canada Ltd., Varnish Works

Montreal

TORONTO

Winnipeg

Tenders

A few dollars spent in advertising your proposals in the

**Contract Record
and Engineering Review**

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

LACKAWANNA STEEL SHEET PILING

Lackawanna type of steel sheet piling, as represented by various sections manufactured, conforms to the requirements of all round usefulness to a greater extent than any other ever offered and can be installed without surplus weight and at the lowest price per square foot of piling wall in place.

Sales Agents

H. A. Drury Co.

Montreal and Toronto Limited

Gravity System Distributing Concrete



Gravity System Equipment on Large Concrete Building

A system that improves the concrete and reduces the cost.

Information gladly furnished and estimates given on any work.

Canadian Concrete Appliance Co., Ltd.

Sole Licensees for Canada

613 Vancouver Block,
VANCOUVER
B. C.

Eastern Representatives
Stinson Reeb Builders'
Supply Co., Ltd.
Montreal, P. Q.

SHEARER & MAYER DRAGLINE CABLEWAY EXCAVATOR

Patented and Manufactured in United States and Canada

A Simple, Rapid, Efficient and Economical

Machine for excavating material and conveying it to cars, plant or stock piles.

This machine operated with a double drum hoist, Digs, Conveys, Elevates and Dumps in one continuous forward operation under POSITIVE CONTROL of one operator.

Large radius of operation.

Wide range of adaptability.

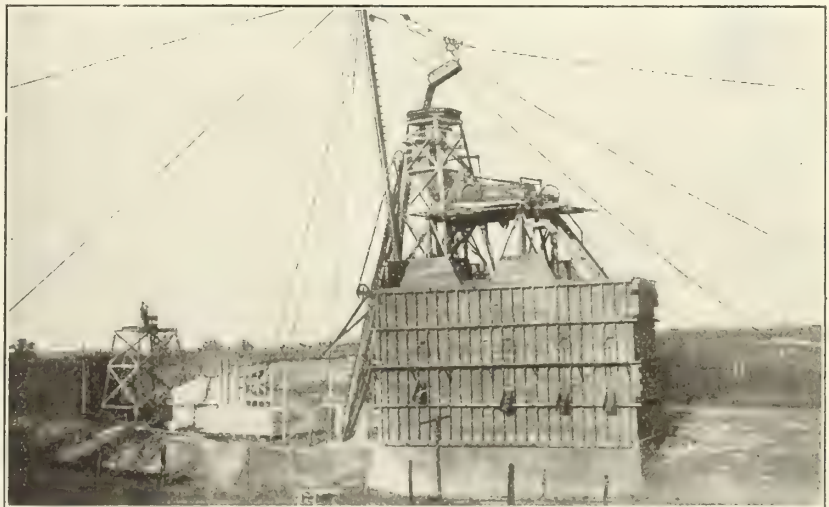
Write us your conditions and requirements.

SAUERMAN BROS.

1140 Monadnock Block
CHICAGO, ILL.

ALBERTA and SASKATCHEWAN Agents

Canadian Equipment & Supply Co.
Calgary Edmonton Regina



THE H. & E. PATENT BALL-BEARING LIFTING JACK

For Railway and Bridge Work, Contractors' and Builders' Use



Made by practical Jack Builders. Material: best grades of malleable iron and steel. Fully guaranteed as to durability and efficiency. The long even stroke of the lever together with the design and careful construction of the Jack, makes it the quickest and easiest working lifting appliance on the market. Made in plain and foot-lift styles. Adapted to all classes of work where a lifting jack can be used. Sizes from 8 to 50 tons capacity now complete. Send for prices and discounts.

To any responsible Firm or Railway in Canada any of these jacks will be sent on 30 days trial.

Manufactured by

Canadian Brakeshoe Co.,
SHERBROOKE, QUE. Limited

Stock carried by F. H. Hopkins & Company, Montreal





CONTRACTORS' EQUIPMENT

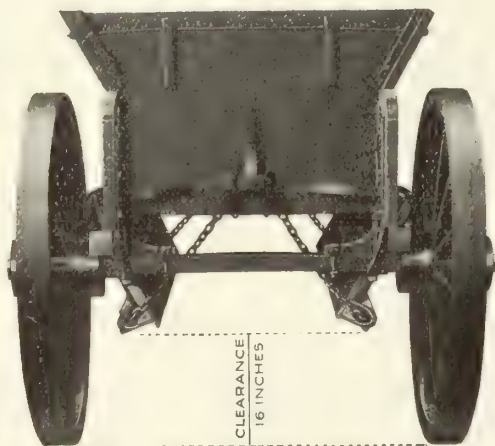
Steam Hoists, Electric Hoists, Horse Powers, Belt Hoists, Hand Winches, Derricks, Car Wheels, Axles and Boxes, Dump Cars, Rail Cars, Buckets, etc.

Do not wait for the Spring rush, order now and have your plant ready for an early start.

Marsh & Henthorn, Limited - Belleville, Ont.

Makers of Hoisting Machinery

Sales Agents—
Mussens, Limited,
Montreal, Que.



The Last Ten Dollars

in a dumping wagon is the best part of its price. It may mark the difference between the commonplace and the excellent.

Watsons cost you more. They are not sold on price. And yet thousands more buy the Watson every year. Nobody will give you something for nothing. We don't claim to. Why not get the Watson catalog?

John Deere Plow Co. of Welland, Ltd.
77-79 Jarvis St., Toronto, Ont.

Brick Today Stone Tomorrow

Properly made sand lime brick of the best materials will eventually turn to stone under the influence of nature. Those desiring strong and permanent building material should

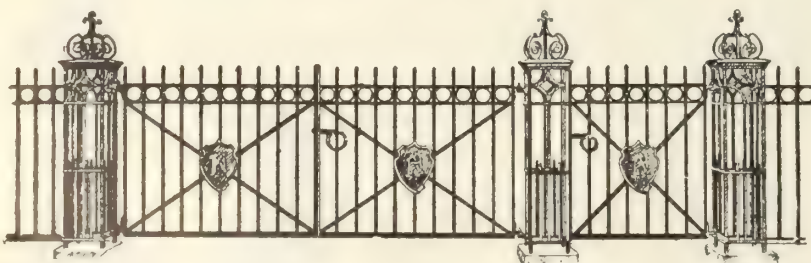
SPECIFY "Harbour" Sand-Lime Brick

Harbour Brick Co., Limited

50 Front Street E.

Toronto

Iron Fence and Grill Work



If you have any special designs, monogram plates or particular work in ornamental iron, you can depend upon us to faithfully fashion your designs.

Prices and Particulars cheerfully furnished.

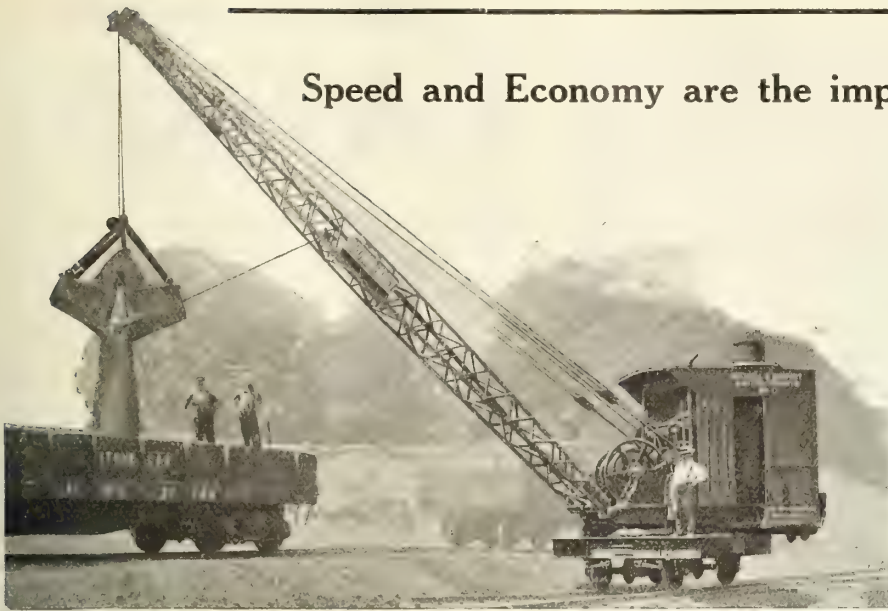
WE ALSO DO IRON STAIR WORK

The Geo. B. Meadows

Toronto Wire, Iron & Brass Works
Co., Limited

TORONTO, - ONT.

MEADOWS BLOCK, WELLINGTON ST. WEST



Speed and Economy are the important factors of your costs

when handling sand, gravel, crushed stone, coal, ore, etc., from and to cars, wagons, bins, and stock piles.

BROWNHOIST Locomotive Cranes

will handle your material speedily and economically.

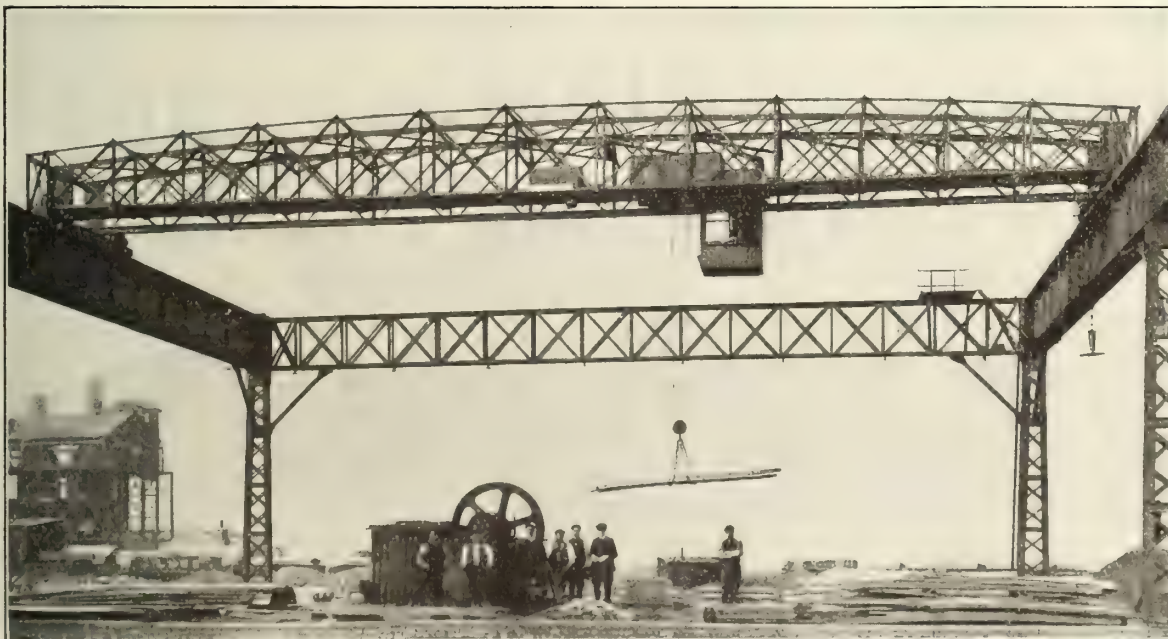
10-ton Brownhoist Locomotive Crane used by Britnell & Co., Ltd., Toronto, Canada.

Speed The Brownhoist Locomotive Crane handles 60 to 120 tons per hour of these loose materials, with one or two men besides the operator. It replaces 20 to 30 men on this kind of work.

Economy The cost of the crane is \$8 to \$9 per 10 hr. day, which includes operating, interest on the investment and depreciation. By replacing 25 men, it saves \$30 to \$40 per day. And the crane can be worked both day and night.

Send for Catalog K which shows how and where these cranes are used

THE BROWN HOISTING MACHINERY CO., CLEVELAND, O.
 New York Pittsburgh Chicago San Francisco Portland, Ore., The Colby Engineering Co.



Yard Crane at Steel Mill of Sir Alfred Hickman, Limited, Bilston, Staffordshire

YOUR ENQUIRIES ARE SOLICITED FOR
 CRANES TELFERS CAPSTANS WINCHES

ROYCE, LTD., Trafford Park, Manchester, England

**Royce
Electrical
Cranes
Capstans
Telfers
Winches**

*Include
Royce
Crane Type
Motors,
Controllers,
Over
Hoisting
Safeguard.*





TANKS

for

Pulp and Paper Mills
Chemical Works
Oil Refineries, Etc.

We also build

Steel Structures
to support them.

Write us for quotations

**MacKinnon, Holmes
& Company Limited**
SHERBROOKE, QUE.

Municipal Filtration and Water Softening Plants

Designed,

Installed and

Operated

by Experts

We GUARANTEE

Results under all

Conditions

Write us for our "Red Book" on Water Softening and Purifying

Messrs. The Paterson Engineering Co.

Canadian Agents:

LAURIE & LAMB

Board of Trade Building, MONTREAL

“Superior Graphite Paint” For the Protection of Steel

Is used so largely because it has behind it a successful reputation of 25 years. Its use insures either exposed or enclosed surfaces, against rust.

Leading ENGINEERS and ARCHITECTS specify “Superior Graphite Paint” for all metal work because for similar work it has shown ACTUAL PROVEN MERIT.

Write for new booklet on PROTECTING STEEL STRUCTURES, and for full information to

Dominion Paint Works, Limited

Montreal
Toronto

Walkerville, Ont.

Made in U.S.A. by Detroit Graphite Co., Detroit, Mich.

Winnipeg
Vancouver

TENDERS FOR WORK

We would be pleased to submit prices on timbers of any description for building,

Tugs	Dredges	Scows
Wharves	Coal Shoots	or Piling

It would be entirely to your advantage to have competitive prices on your requirements, and to have our prices even if only as a matter of record.

OUR MILLS RUN ALL WINTER.

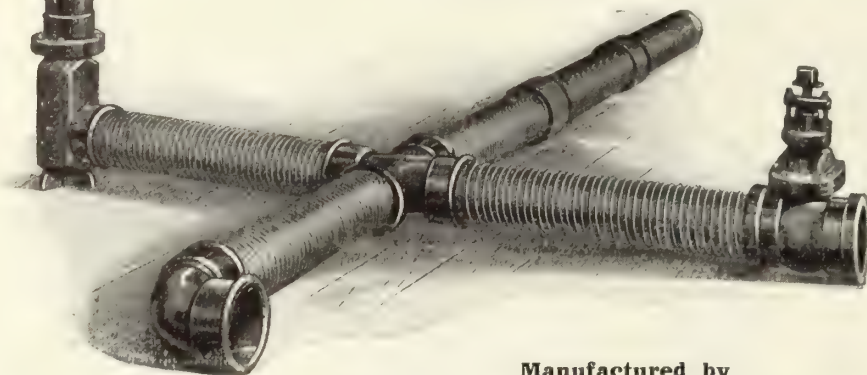
JAMES SHEPPARD & SON
SOREL, QUE.



Wooden Water Pipe

**Galvanized Wire Wound and Continuous Stave Pipe
for Water Works, Power, Irrigation, etc.**

Withstands 250 lb. working pressure.



Not affected by Frost,
Corrosion, Electricity or
Acid. Water Works Sys-
tems installed. Prompt
attention to inquiries.

Write for prices.

Manufactured by

Canadian Pipe Co., Limited

P.O. BOX 915

Factory: 550 Pacific St., VANCOUVER, B. C.

Another Big Contract



The new plant of the Northern Aluminum Company, Toronto. The contract for roofing and sheet metal was executed by us.

We specialize in

**The Built up Pitch, Felt and Gravel Roofing, Damp-proofing
Foundations, Slating, etc.**

We also manufacture

**SKYLIGHTS, CORNICE, FIRE DOORS AND WINDOWS, TIN CLAD DOORS, ASPHALTS,
TARRED AND DRY FELTS, COAL TAR PITCH**

We will quote you attractive prices on any of the above—write us.

REGGIN AND SPENCE

Roofing and Sheet Metal Contractors

530 Front Street West

Toronto

Protect Your Buildings As Well as Insure Them !

Prevention of fires is vastly better than the partial redress which is all the best Fire Insurance Policy can give you. This prevention is easily secured by using

Asbestocement Building Materials



make roofs that are handsome, *fireproof*, practically everlasting and moderate in price.

Linabestos Building Board prevents inside fires from spreading. It is quickly applied, and gives a permanent, attractive, yet inexpensive interior finish.

Asbestos Corrugated Sheathing makes walls and roofs for Garages, Stables, Barns, Warehouses and Factories that are absolutely *weather and fire proof*.

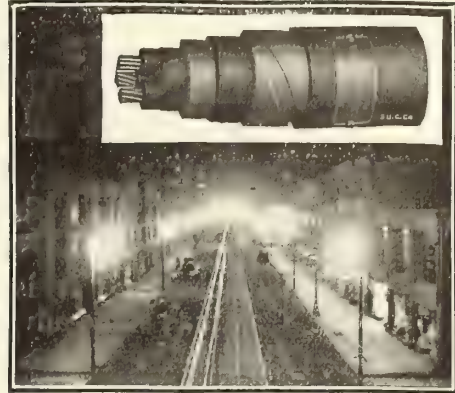
**You build for all time when
you build in Asbestocement.**

Write for Booklet **C. R.** and state in which products you are particularly interested.

Asbestos Mfg. Co., Limited

Address—E. T. Bank Bldg., 263 St. James St.
MONTREAL

Factory at Lachine, P.Q. (near Montreal)



Illumination of Dearborn Street, Chicago, Ill.;
"STANDARD" Steel Tape Armored Cable installed.

Have You Considered

the advantages of installing steel tape armored cable directly in the ground without conduits or man-holes? There are many ways in which such cables can be employed with great economy.

"STANDARD" Steel Tape Armored Cable

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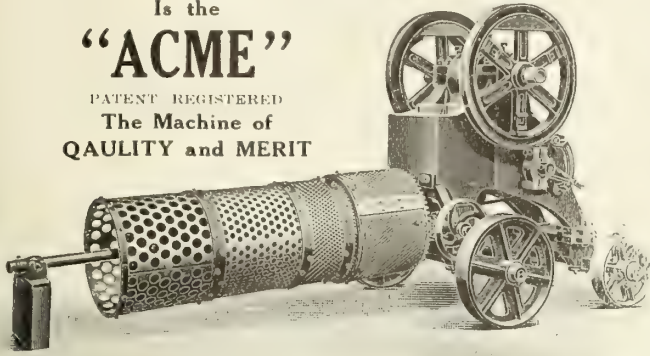
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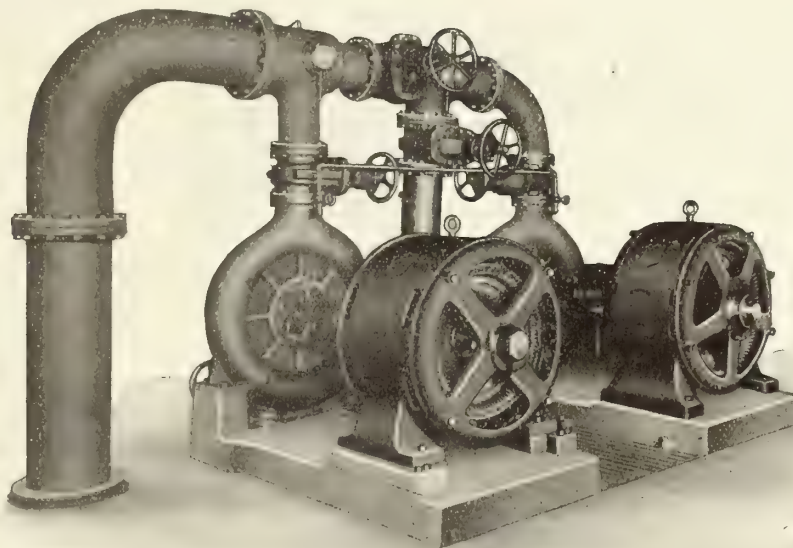
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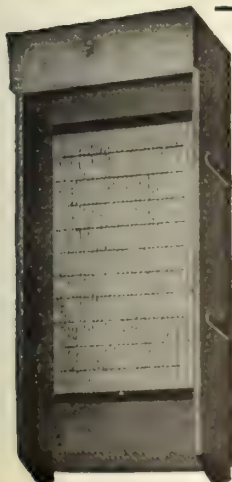
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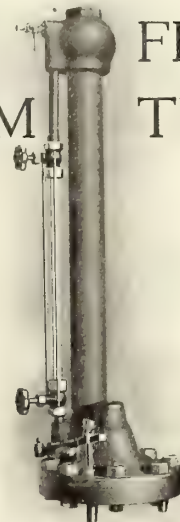
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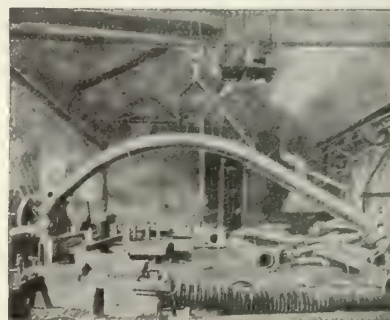
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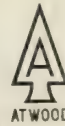
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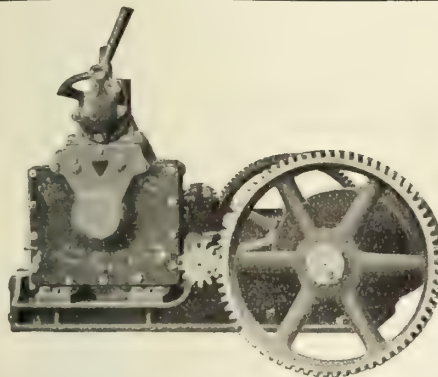
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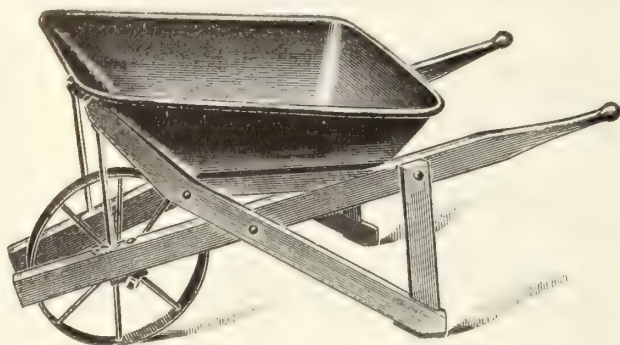
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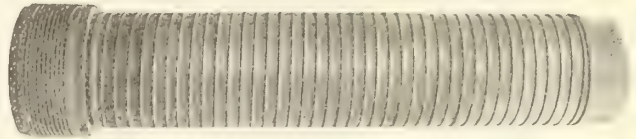
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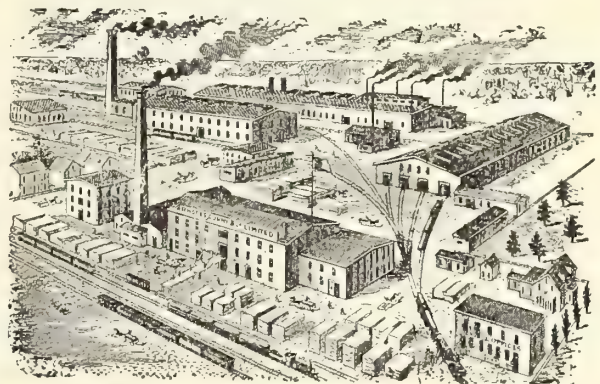
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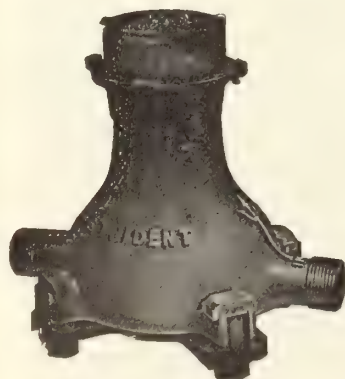
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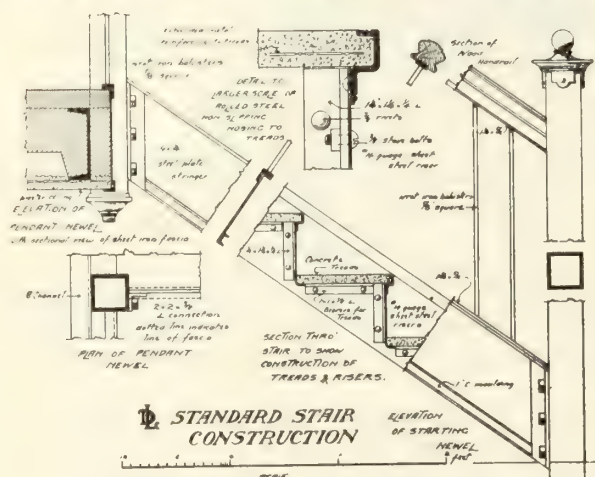
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Size in inches	5/8	3/4
Links per foot	6	5 1/3
Weight 100 ft.	410 lbs.	600 lbs.
Proof Test	13,000 lbs.	18,000 lbs.
Breaking Test	26,000 lbs.	36,000 lbs.
Working Load	8,000 lbs.	11,000 lbs.

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with one of our "Majestic" Coal Chutes which is the neatest and best equipment for any cellar. It is easily installed in either new or old houses. It permits coal, wood or vegetables to be put into the cellar without disfiguring the building in any way. And unlike a glass window it cannot be broken. The hopper can easily be removed if desired to put in very coarse coal or wood, or if a waggon chute is used. It swings back into the chute and allows the door to be closed. The door is made to lock when opened upward, and protects the wall or siding above the chute, and can be released only when closed. We make three standard sizes. There's a size that's just right for your cellar and your requirements. No. 1—22 x 16 x 13. No. 2—27 x 16 x 13. No. 3—33 x 22 x 18.

Send for our illustrated booklet, it shows and describes our full line of Coal Chutes

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Current Prices of Building and Engineering Materials

BRICKS

The following are wholesale prices delivered at Toronto:

	Per M.
No. 1 dry pressed red brick	\$18 00
No. 1 dry pressed buff brick	18 00
Red Stock Brick	13 00
Grey Stock Brick	12 00
Wire cut brick for foundation work	11 00
Porous terra cotta brick	15 00
No. 1 enamelled brick, all colors, from	\$80 00 to \$150 00
Sand-Lime Brick (King Edward Siding)	8 10

LUMBER (Building Material)

Hemlock Lumber—

2 in. x 4 in. to 2 in. x 12 in., 8 to 14 ft.	\$26 00	
2 x 4 to 2 x 12, 16 ft.	26 00	
2 x 4 to 2 x 12, 18 ft.	29 00	
1 in. Hemlock, No. 1	25 00	26 00
No. 1 Hemlock Decking	25 00	26 00
No. 2 Hemlock dimension and 1-in.	19 00	21 00

Pine—

1 in. common pine 8 to 12 in. wide rough	26 00	30 00
2 in. white pine Bill stock	29 00	33 00
¾ x 8 and 10 in. pine shelving	36 00	42 00
¾ x 12 in. pine shelving	45 00	
No. 1 white pine flooring	33 00	
No. 1 spruce flooring	28 00	
No. 1 pine decking D2S	30 00	
Spruce Decking	28 00	30 00
No. 1 pine V. or beaded sheeting	36 00	
No. 2 pine V. or beaded sheeting	32 00	

Pine trim for paint finish—

4 in. casing per 100 ft.	2 00
5 in. casing per 100 ft.	2 50
8 in. pine base, per 100 ft.	3 50
10 in. pine base, per 100 ft.	4 50
4 in. pine window stool	2 75

Shingles—

XXX B. C. Clear Shingles, per M.	3 75
N. B. Extras	3 75
N. B. Clears	3 10
No. 1 pine lath, per M.	5 00
No. 2 pine lath	4 50
No. 1 spruce lath	4 00

Cedar Posts—Fence—

5 in. at small end, each	25
7 in. at small end, each	35
Hemlock lath	3 50

Dimension Timber up to 32 feet:

8x8, 10x10, 10x12, 12x12, 12x14	32 00
8x10, 8x12, 10x14, 14x14	34 50
8x14, 12x16, 14x16, 16x16	34 50
10x16, 14x18, 16x18	35 50
8x16, 12x18, 18x18	36 00
10x18, 14x20, 16x20	36 50
8x18, 12x20, 18x20	37 00
10x20	37 50
8x20, 14x22, 16x22, 18x22, 20x22, 22x22	38 50
12x22	39 00
10x22	39 50

8x22, 14x24, 18x24, 20x24, 22x24, 24x24	40 50
12x24	41 00
10x24	41 50
8x24	43 50

WINDOW GLASS

Following are the prices of glass at Toronto, Hamilton and London. The discounts are 20 per cent. for Star and 20 per cent. for D.D.

	Star	D.D.
10 to 25 united inches	\$4 25	\$6 25
26 to 40 "	4 60	6 75
41 to 50 "	5 10	7 50
51 to 60 "	5 35	8 50
61 to 70 "	5 75	9 75
71 to 80 "	6 25	11 00
81 to 85 "	7 00	12 50
86 to 90 "		15 00
91 to 95 "		17 50
96 to 100 "		20 50
101 to 105 "		24 00
106 to 110 "		27 50

The following are wholesale prices for glass at Montreal and jobbing prices at Winnipeg for box lots:—

MONTREAL

	Star	D.D.
25	\$3 25	\$4 75
40	3 45	5 20
50	3 85	6 00
60	4 10	6 50
70	4 35	7 00
80	4 85	7 50
90		9 75
95		10 75
100		12 50

Net prices per 100 feet F.O.B. Montreal.

WINNIPEG

	4ths Single	3rds Double
Up to 25 u.i.	\$3 50	\$5 00
26/40	3 75	5 50
41/50	4 25	6 25
51/60	4 75	7 00
61/70		8 00
71/80		9 00
81/85		10 00
86/90		11 00
91/95		13 00
96/100		16 00

Net prices per 100 ft. F.O.B. Winnipeg.

STEAM FITTERS' AND PLUMBERS' SUPPLIES

Standard compression work, 65 per cent.
High grade compression work, 55 and 5 per cent.
Fuller work, 65 and 5 per cent.; No. 0, 70 and 10 per cent., and 1 and 2 basin cocks, 70 per cent.
Flatday stop and stop and waste cocks, 60 and 70 per cent.; roundway, 60 and 5 per cent.
No. 4 compression bath cock net\$1.85
No. 4½ Fuller's net\$2.35
Square head brass cocks, 65 and 5 per cent.

Lead Pipe

Lead pipe, \$7.50; less 5 per cent.; lead waste, \$9.00, less 5 per cent.; caulking lead, 6¼ cents per lb.; traps and bends, 40 per cent.; pig lead, 6¼ cents per lb.

Size (per 100 ft.)	Black	Galvanized
¼ inch	\$2.16	¾ inch \$3.06
⅜ "	2.16	¾ " 3.06
½ "	2.64	¾ " 3.57
¾ "	3.05	¾ " 4.20
1 "	4.51	1 " 6.21
1 ¼ "	6.10	1 ¼ " 8.40
1 ½ "	7.29	1 ½ " 10.04
2 "	9.81	2 " 13.51
2 ½ "	16.80	2 ½ " 21.65
3 "	20.66	3 " 28.31

Cast iron fittings, 65; headers, 65; flanged unions, 70; malleable bushings, 67½; nipples, 4-inch diameter and under, 75 and 10; nipples, 4½-inch and up, 70 and 10; malleable lipped unions, 67½ per cent.

Soil Pipe and Fittings

Medium and extra heavy pipe and fittings, up to 6-inch, 65 and 10 per cent.
7 and 8-inch pipe, 45 per cent.

Sewer Pipes

4-in. 25c ft.	15-in. 1.40 ft.
6-in. 40c ft.	18-in. 1.90 ft.
9-in. 70c ft.	20-in. 2.25 ft.
12-in. 1.00 ft.	24-in. 3.25 ft.

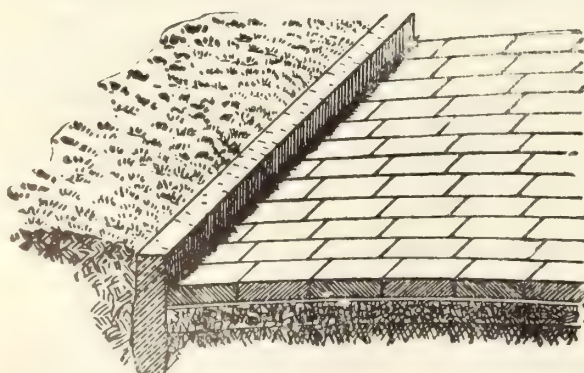
all less 60 per cent.

CEMENT, STONE, STEEL, Etc.

Cement, barrel lots, in bags, delivered, Toronto, bags, extra, \$1.80.
Cement, wholesale, car lots, f.o.b. Toronto, bags extra, \$1.55.
Crushed stone, 2-inch, \$1.40; 1-inch, \$1.45; ¾-inch, \$1.45.
Burnt River rubble stone delivered, \$16 to \$17 per ton.
Plain steel bars, \$2.25.
Square twisted bars, ¼ to 1¼, \$2.35.
Malleable fittings — Canadian discount, 45 and 42½ per cent.
Free stone delivered, \$15 to \$18 per ton.
Brown coursing stone, delivered, \$3.75 per yard.
Grey coursing stone, delivered, \$2.50 to \$2.75 per yard.
Sand, for cement or brick work, \$1.20 a cubic yard, f.o.b. Toronto, C. P. R. siding.
Sand, for cement or brick work, 85c to \$1.00 a cubic yard, f.o.b. Toronto, G. T. R. sidings.
Brown sills and heads, in the rough, delivered, 40 cents per foot.
Rubble stone in car lots, \$1.30 per ton.
Steel channels and beams, angles and plates, \$2.55 to \$2.90 per 100 pounds, delivered f.o.b. Toronto.
Hard Wall Plaster, unsanded from \$8.00 to \$8.50, bags extra; sanded, \$4.00 in car lots; hydrated lime, \$10.00 in car lots.
Lime per cwt., delivered, not less than 1,500 lbs. 38 cents; white, 40 cents.
Plaster of Paris, Anchor and Crown Brands, \$1.50 bbl.
Manilla Rope, best, per pound, 12½ cents.

PAINTS AND OILS

Pure White Lead, ground in oil, \$8.75 per 100 lbs.
Boiled Linseed Oil in bbls., 65c per gal. of 9 lbs.
Raw Linseed Oil, in bbls., 62c per gallon.
Pure Red Lead, dry, \$7.00 to \$8.00 per 100 lbs.
Putty, pure linseed oil, in bulk, bbls., 3½c.
Putty, pure linseed oil, in 25-lb. tins, 4c.
Turpentine in bbls., 66c.



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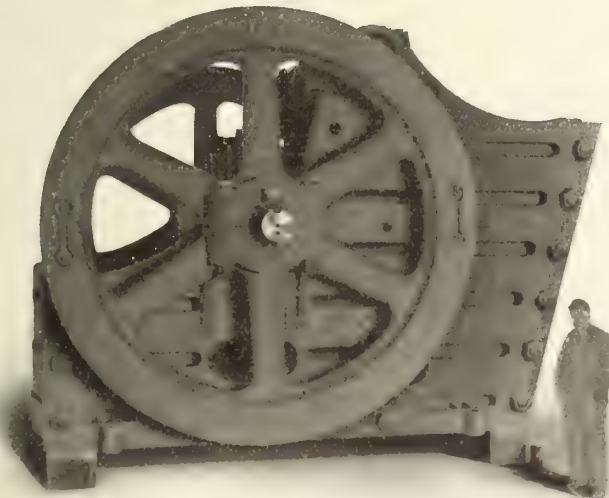
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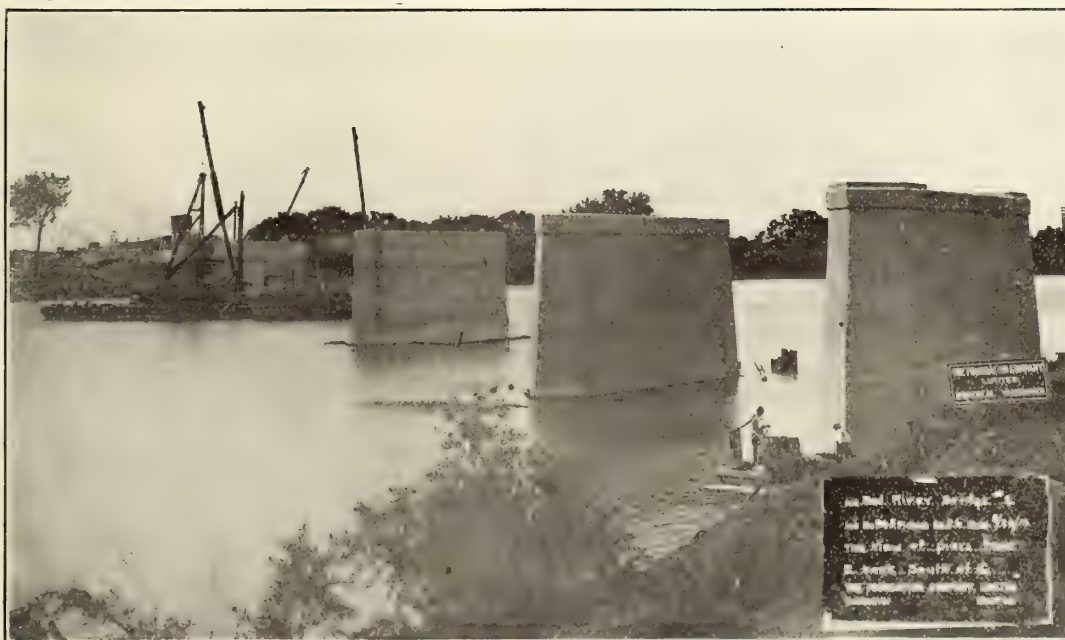
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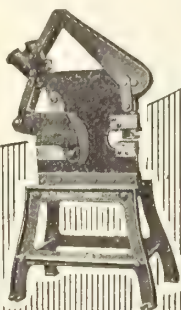
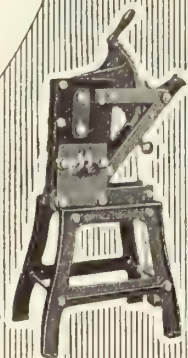
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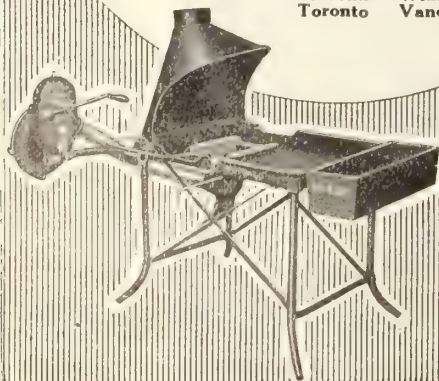
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Sewage Disposal in the United Kingdom, by Henry Lemmoin Cannon. Published in 1912 by St. Bride's Press, London, Eng. 320 pages; illustrated. Price \$1.00.

Strength of Materials, by Edward H. Maurer. Published in 1908 by American School of Correspondence. 128 pages. Illustrated. Price 75c.

The Modern Asphalt Pavement, by Clifford Richardson. Published in 1910 by John Wiley & Sons, New York. 630 pages; illustrated. Price \$2.00.

Text-Book on Highway Engineering, by Arthur H. Blanchard. Published in 1913 by John Wiley & Sons, Inc., New York. 762 pages. Illustrated. Price \$3.00.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1116 pages. Illustrated. Price \$1.50.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

Iron & Steel, by O. F. Hudson. Published in 1913 by Constable & Company, Limited, London. 174 pages. Illustrated. Price \$1.00.

Asphalt Construction for Pavements and Highways, by Clifford Richardson. Published in 1913 by McGraw-Hill Book Company, New York. 156 pages. Illustrated. Price \$1.50.

Concretes, Cements, Mortars, Plasters and Stucco, by Fred T. Hodgson. Published in 1906 by Frederick J. Drake & Co., Chicago. 520 pages. Price \$1.00.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price \$1.00.

Specifications for Street Roadway Pavements, by S. Whinery. Published in 1913 by McGraw-Hill Book Company, New York. 116 pages. Price 75c.

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Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price \$1.00.

Reinforced Concrete Construction, by George A. Hool. Published in 1912 by McGraw-Hill Book Company, New York. 254 pages. Illustrated. Price \$2.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price \$2.00.

A Treatise on Concrete Plain and Reinforced, by Frederick W. Taylor. Published in 1905 by John Wiley & Sons. 584 pages. Illustrated. Price \$1.50.

Engineering as a Vocation, by Ernest McCullough. Published in 1911 by David Williams Company, New York. 200 pages. Price 50c.

The Sanitation of a Country House, by Dr. Harvey B. Bashore. Published in 1905 by John Wiley & Sons. 102 pages. Illustrated. Price 50c.

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1. How many horses have you?
2. How much money have you invested?
3. How much does it cost per day to operate your teams?
 - (a) Including interest on total investment for horses, trucks, harness and other equipment?
 - (b) Stable charges?
 - (c) Drivers, etc.?
4. What is the life of a horse?
5. Do you figure depreciation on this basis?
6. How many cubic yards or tons can you haul per day?
7. Are you willing to be convinced that motor trucks can do this amount of work at a lower cost?
8. Can you improve your loading and unloading facilities to reduce time lost in this way?



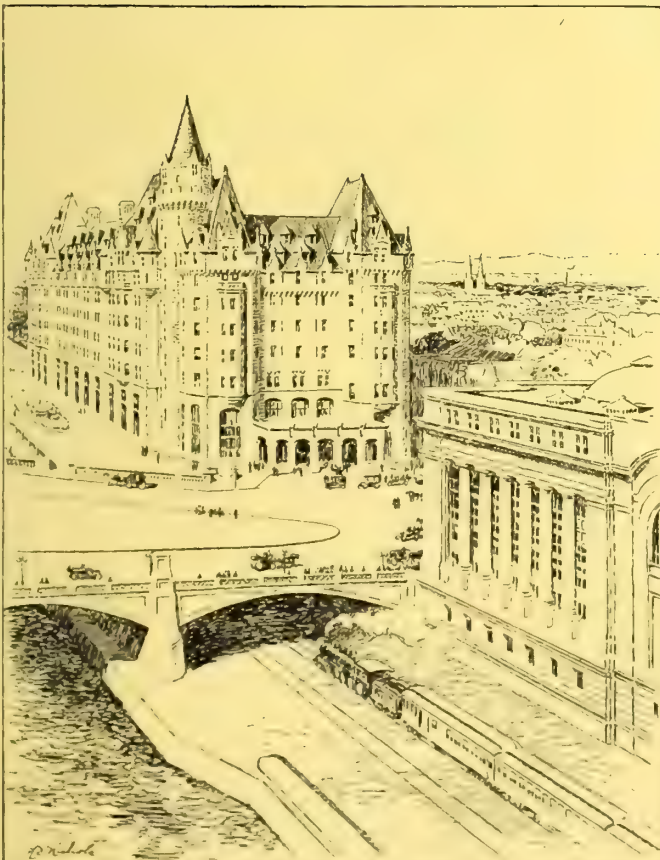
The Perry Sand Co., of Buffalo, using Mack Trucks

9. What is your average length of haul?
10. How many trips can you make with horse trucks?
11. Do you know that a single automobile truck is doing the work of four horse teams in your business?
12. Is there any reason why the automobile truck cannot do as much for you?
13. Isn't it worth your while to investigate this situation?

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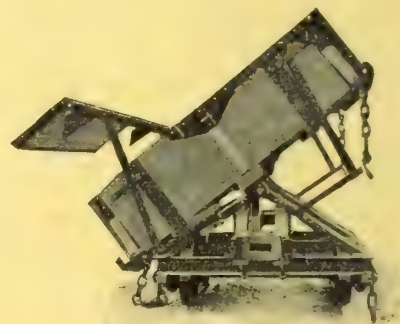
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We supply Dump Cars in all sizes—suitable for any practical gauge track. These Dump Cars are well built and will withstand very severe service. Cars supplied with either wood or steel underframe.

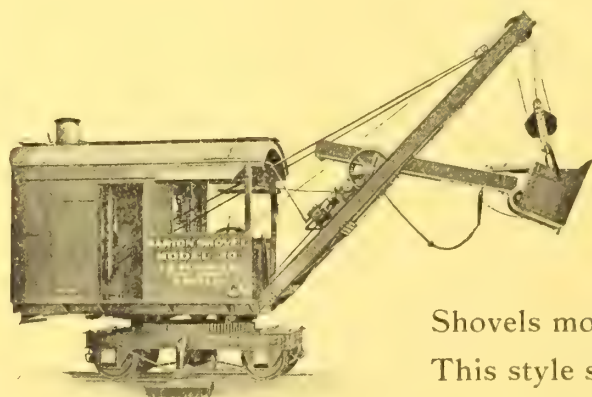


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This type shovel is supplied in three sizes
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Shovels mounted on Traction Wheels or Railroad Trucks.
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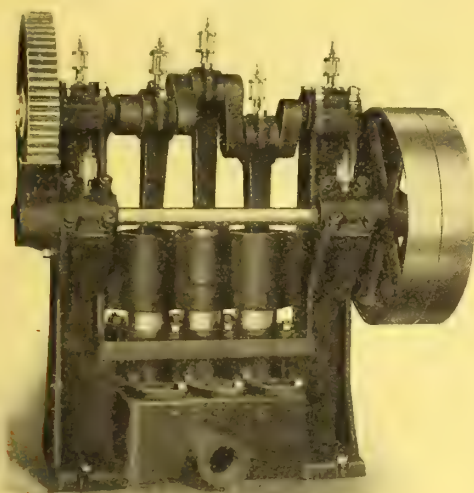
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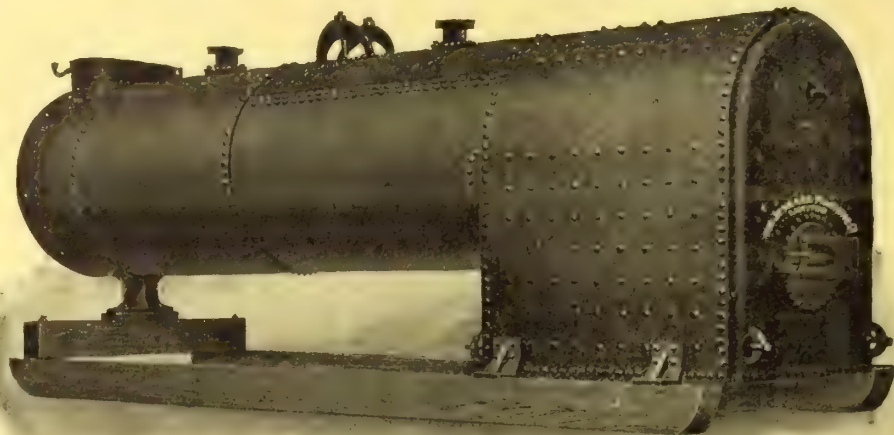
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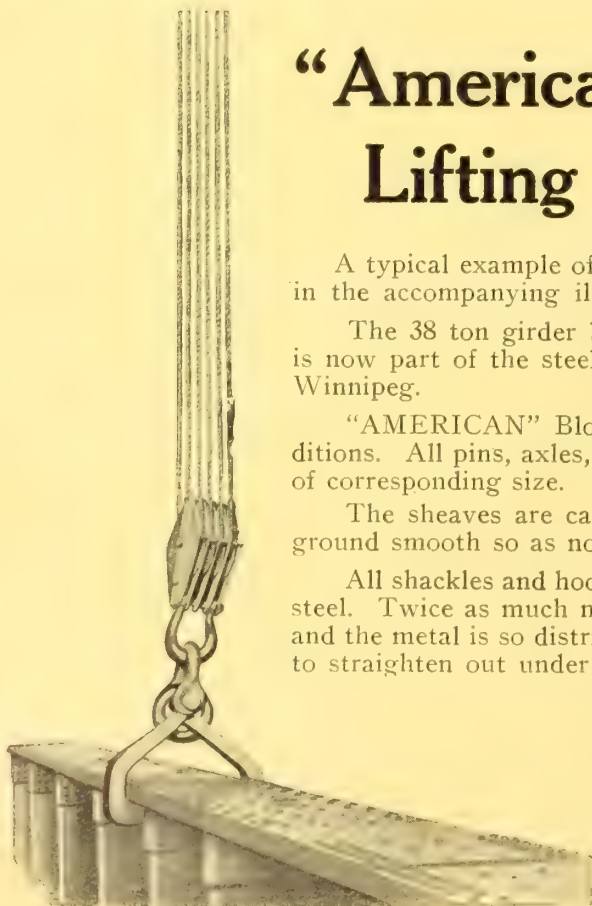
The sheaves are cast from special hard iron and the groove is carefully ground smooth so as not to chafe and injure the rope.

All shackles and hooks are extra heavy and drop forged from special test mild steel. Twice as much metal goes into them as into ordinary hooks and shackles, and the metal is so distributed as to present the greatest resistance to the tendency to straighten out under stress.

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Write us for complete information about Concrete Bridges, large or small.



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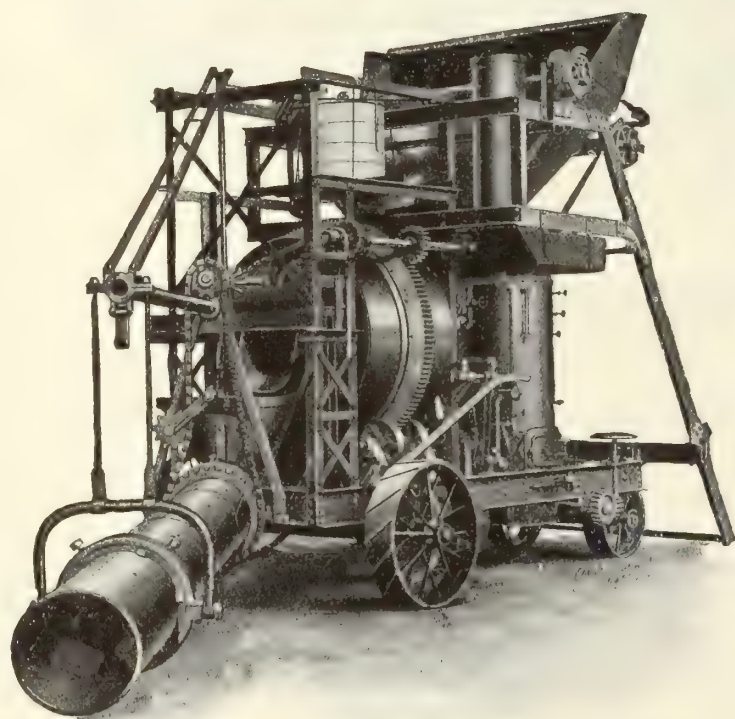
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It means a Batch
Mixer with a contin-
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It means an extremely large output of the best material.
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The Boss of the Road

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Note the Wide Loading Skip—Three wheelbarrows can be dumped into it at the same time.

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*See our Exhibit of Road Machinery at the
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(Continued on page 12)



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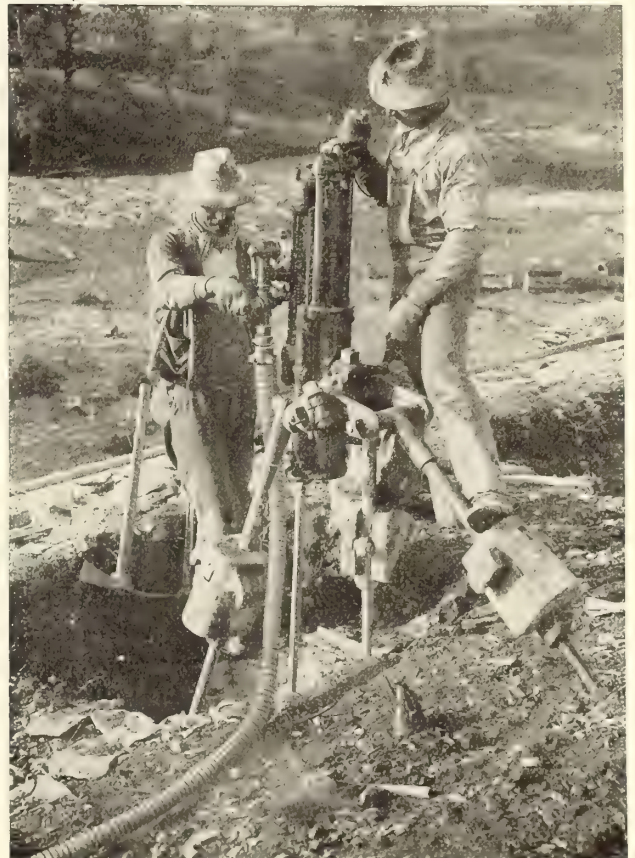
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The armour is interlocked in such a manner that there can be no undue strain on the rubber hose while carrying it about, and, while it may seem strange, it is nevertheless true that Sprague Flexible Steel Armoured Hose offers increased flexibility over an unarmored hose.

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The use of a sheet metal that will resist corrosion is the logical method of reducing the corrosion of iron and steel.

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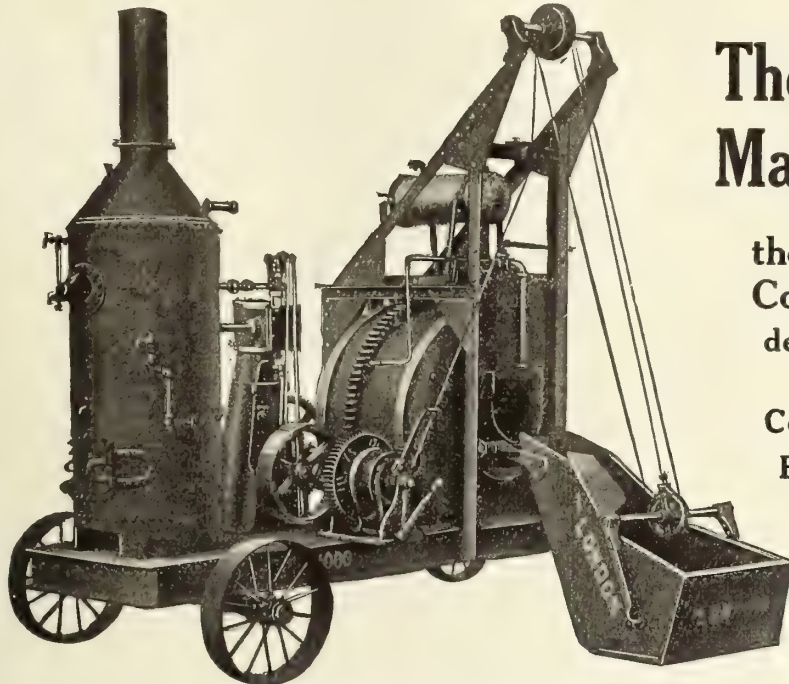
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London Standard Drum Batch Mixer
This machine is built in five sizes, fitted with any kind of power; also with traction drive if required.

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This morning I saw ten houses under construction, each by a different builder.

Each house had cement stucco forming part or all of the outside wall. In every case the stucco was applied on Herringbone Metal Lath. Ten years ago it would have all been on wood lath.

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Winnipeg

General Sales Agent

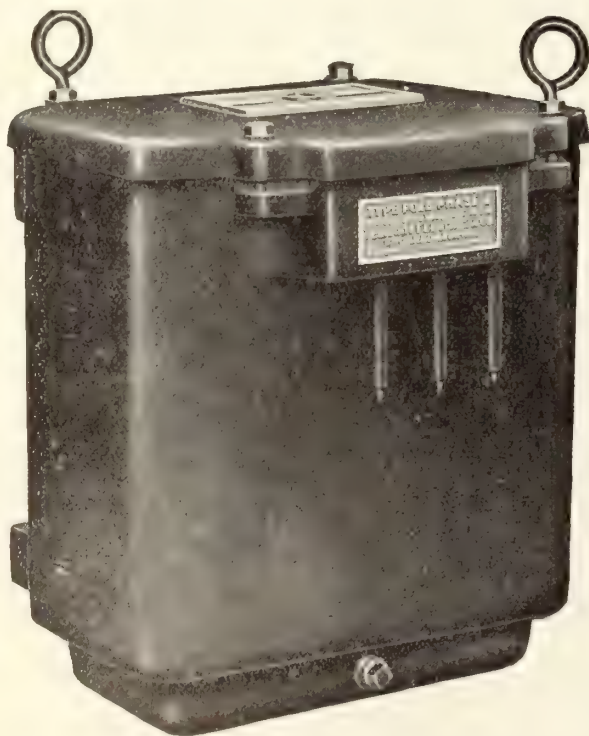
117 Home Life Building, TORONTO

Montreal

The Metal Shingle & Siding Company, Manufacturers

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Ferranti Transformers

A transformer to be efficient must be economical to install, economical to operate and must have a minimum of core and copper loss. These good points will be found in Ferranti Three Phase Transformers.

Whether on the line or in the station Ferranti Transformers will give all-day high efficiency.

The design is very substantial and all parts are easily accessible.

Let us quote you prices

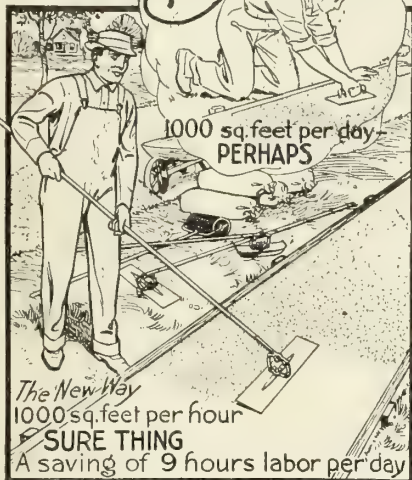
The Ferranti Electrical Co. of Canada, Ltd.

90 Sherbourne St., TORONTO

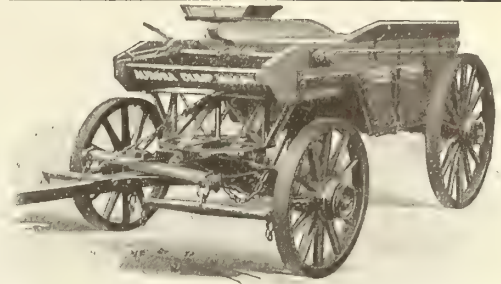
Farmers' Advocate Building,
Cor. Notre Dame & Langside, WINNIPEG

If you are not using
"ABRAM"
TOOLS

It is plain to be seen
 you are
 losing money



Abram Cement Tool Co.,
 Windsor, Ontario



WESTERN

This name on a dump wagon signifies the dawn of a new era in the handling of earth and stone.

The new model Western Dump Wagon has met with enthusiastic praise among contractors and other users.

A new feature in this wagon and one that strengthens more than ever its claim to superiority over any other make of dump wagon, is the addition of a steel channel filled with wood for the main side board.

This innovation gives unusual strength and makes breakage practically impossible.

WRITE US FOR BOOKLET

Western Wheeled Scraper Co.

AURORA, ILLINOIS

Earth and Stone Handling Machinery

Dominion Supply & Equipment Co., Winnipeg-Calgary-Edmonton—Agents for Manitoba, Saskatchewan & Alberta

Canadian Equipment Co., Montreal
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Macadam Roads



must be built
 of a

Tough Stone

that
 will cement

WE HAVE IT

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Pacific Coast Pipe Co.
Piggott & Co., Thos.
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Lecky & Collis

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Morris Machine Works.
Smart-Turner Machine Co.
Waterous Engine Works Co.
Mussens Limited
Ontario Wind Eng. & Pump Co.
Wettlaufer Bros.

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Sewer Trenching
Lecky & Collis

Sound Deadening
Cabot, Inc., Samuel

Stains, Shingle, Cement & Brick
Cabot, Inc., Samuel

Stair Builders
McGregor & McIntyre
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Say About This Koppel Car

A detailed technical illustration of a Koppel Dump Car, shown from a side-rear perspective. The car has a large rectangular body with "KOPPEL Dump Car" and "4 Yards - 36 Gauge" printed on its side. It features a robust steel underframe and draft beam at the rear. Several circular callout boxes point to specific components: "OUT OF CASK" points to the top edge; "WHEELS" points to the front axle assembly; "RAILROAD RAIL" points to the track surface; "CAST STEEL WHEELS" points to the front wheels; "STEEL UNDERFRAME AND DRAFT BEAM" points to the rear chassis; "COUPLER MAIN" points to the coupling mechanism; and "COUPLER END" points to the end coupler. The entire illustration is framed by a decorative border.

(Continued on page 16)

St. John Quebec Montreal Ottawa Toronto Winnipeg Saskatoon Calgary Vancouver Victoria



Capacity 4000 Tons Daily

Crushed Stone

For all purposes
Any size
Any quantity
We ship promptly
Let us quote you
prices on your
requirements.

Canada Crushed Stone Corporation, Limited

Dundas

Ontario

NOTE THE PERPENDICULAR POSITION OF THE Koehring Loader

See that heavy slope? It means that you don't have to thump and bang the loader of the Koehring with a shovel to make it empty readily. The charge slides right out—no trouble—no banging—no denting. A little feature in design but one that's a big time saver.

KOEHRING MIXER

First Among Quality Mixers

Here are other points:

All pinions entirely of steel; all gears of semi-steel; shafting of large diameter; highest grade engine; trunnion rollers keyed to the shaft and faces chilled to an unusual depth and hardness; double geared drive, each gear strong enough to operate the machine; the drum of excellent construction and of such design that three distinct and opposed mixing actions practically keep the batch in the air—this is the "3 in 1" MIXER of which you've heard so much.

All of these construction details are unimportant if they do not combine to give a mixer that does more work.

So, to PROVE the working capacity of a KOEHRING we will place one in competition with any other mixer—to do more work size for size, or, to do as much work with a smaller mixer.

These claims are worth your while to look into. Then, since there's no obligation, do it. Just write—NOW.

KOEHRING MACHINE CO. Milwaukee, Wisconsin

Canada Sales Agent: CANADIAN-ALLIS CHALMERS CO., LIMITED

Toronto

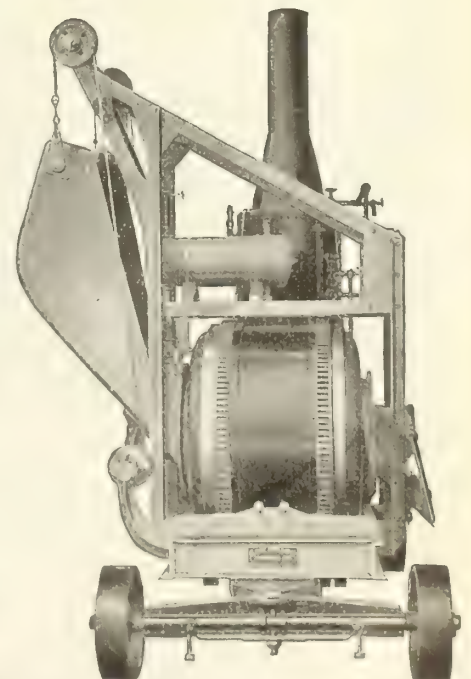
Winnipeg

Calgary

Vancouver

Montreal

Ottawa



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- Wire Rope**
Canada Wire & Cable Co.
Greening Wire Co., B.
- Wrenches**
Canadian Billings & Spencer, Ltd.
- Wrenches**
Can. Billings & Spencer, Ltd.

150 ft. an Hour!—Like Cutting Butter!



Look at the trench walls left by this **AUSTIN** Trench Excavator

digging for the City of Calgary, Alberta, Canada.

Look at the **smoothness** of those trench walls and think of the **SPEED**, and think of the **Boulders**.

Only a **STRAIGHT-PULL**, non-oscillating bucket principle and constantly self-cleaning buckets could do work like that. Allow

Our Canadian Representatives

Lecky & Collis, Limited, 335-A Craig St., Montreal, Quebec, 43 Scott St., Toronto, and P. O. Box 611 Napanee, Ontario.
The Canadian Equipment & Supply Co., Calgary
E. G. Cullen, Vancouver

to present to you all the facts on a machine that will do work like that pictured.

F. C. Austin Drainage Excavator Company

Railway Exchange, Chicago, U. S. A.

Barrett Specification Roofs

Engineers—T. Pringle & Sons, Montreal
and Toronto.
Roofer—R. Gilday, Toronto, Ont.

The Barrett Specification Roof on the
Canadian Fairbanks-Morse Co.,
Ltd., New Shop—Toronto, Ont.



The Choice of First-Class Architects

THE better the building, the more certain that it will have a Barrett Specification Roof, because first-class buildings are the work of first-class architects and engineers and they know the relative values of the different types of roofing.

They know that a Barrett Specification Roof consists of five layers of Specification Felt cemented together with continuous layers of Specification Pitch, with a top surface of slag or gravel. It is built on the roof without the narrow joints or laps of tin of ready roofings.

They know that a Barrett Specification Roof is a substantial, fire-resistant roof, accepted at base rates by insurance underwriters.

They know further that its cost is less than that of any other permanent roofing and that its maintenance cost is nothing, making a net cost per foot per year of service of about $\frac{1}{4}$ cent.

A copy of The Barrett Specification will be sent, on request, to any architect, engineer or property owner. It formulates a precise and practical way of laying these roofs to secure the best results at the least expense. Address our nearest office.

Special Note

We advise incorporating in plans the full wording of The Barrett Specification, in order to avoid any misunderstanding.

If any abbreviated form is desired, however, the following is suggested:

ROOFING — Shall be a Barrett Specification Roof laid as directed in printed Specification, revised August 15th, 1911, using the materials specified and subject to the inspection requirement.

THE PATERSON MANUFACTURING CO., Limited

Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S. Sydney, N. S.

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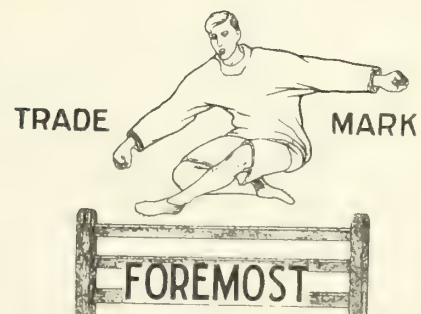
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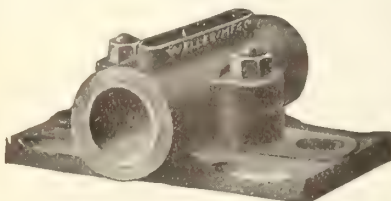
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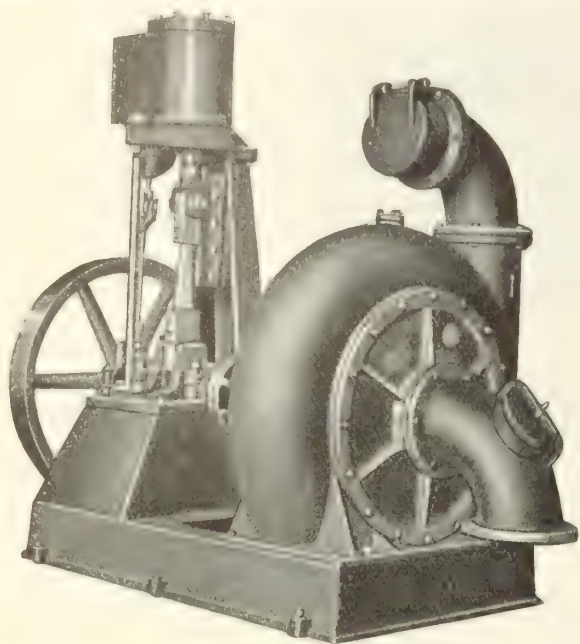
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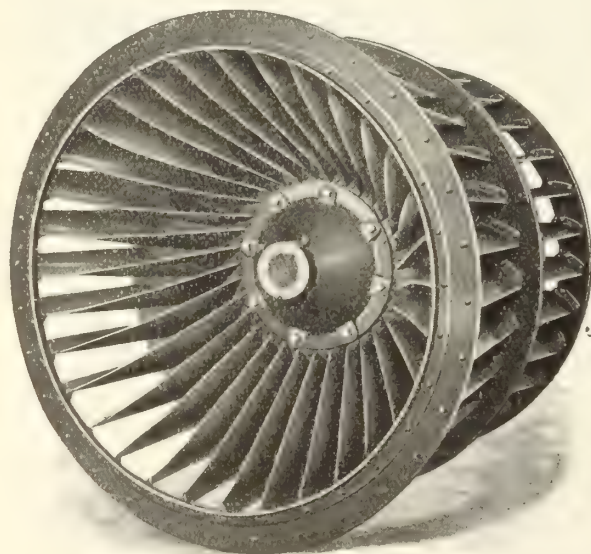
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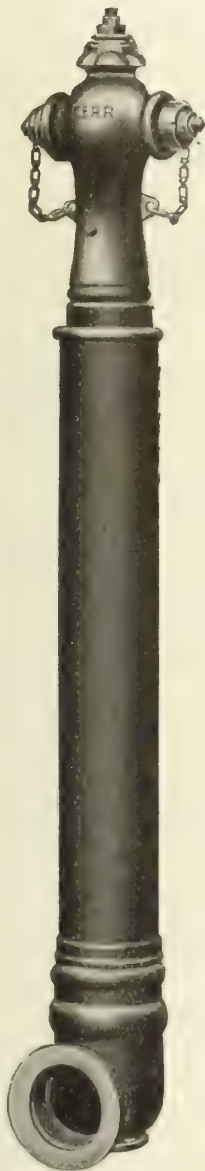
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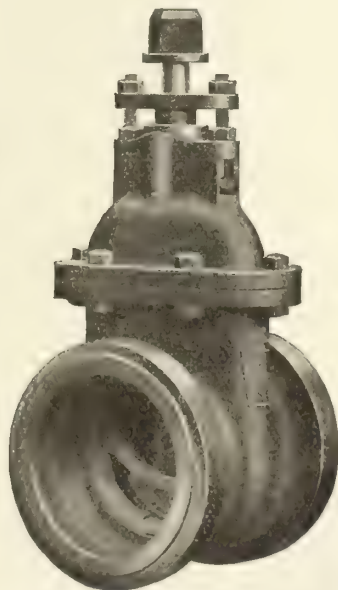


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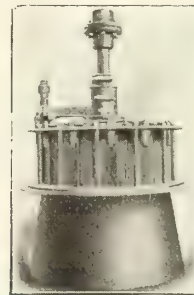
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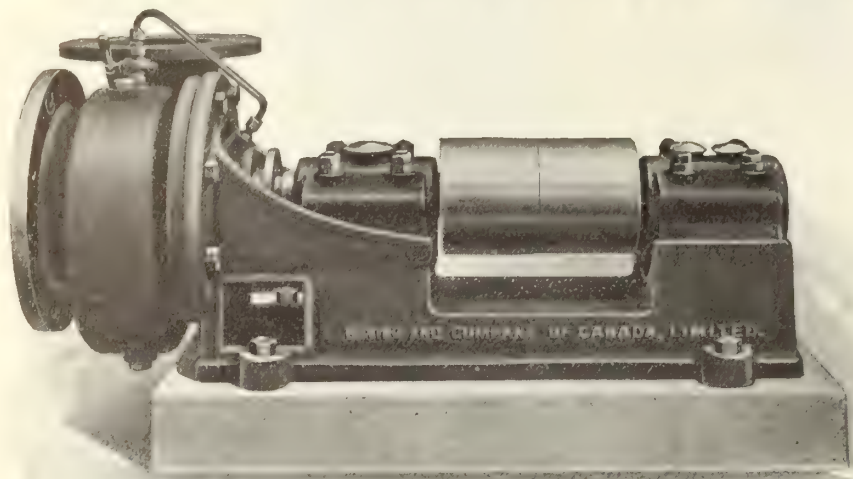


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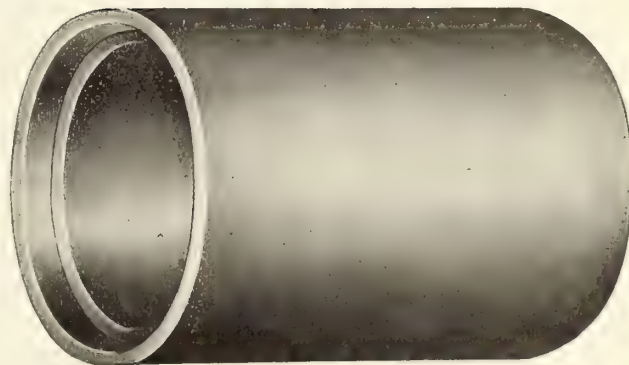
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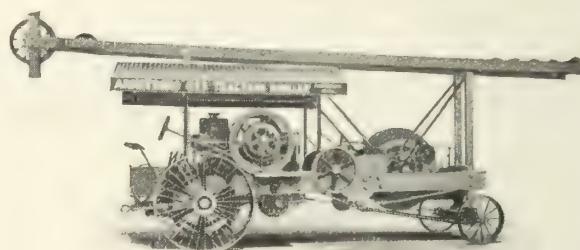
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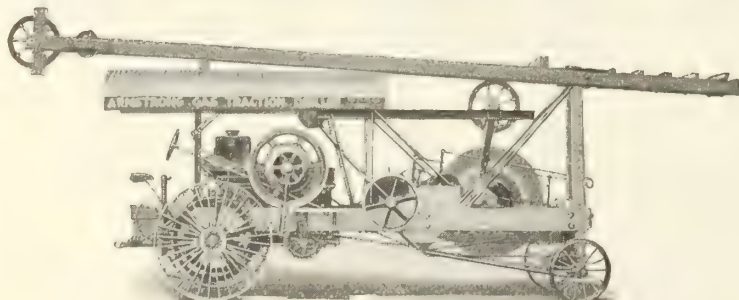
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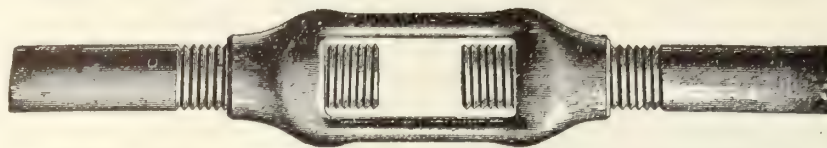
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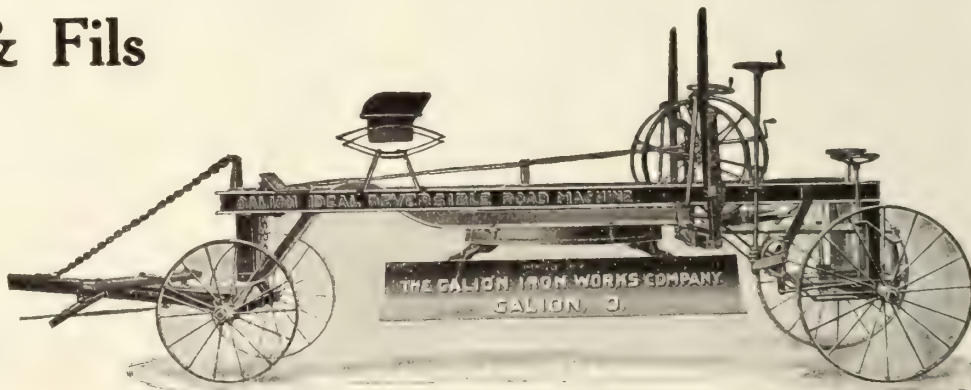
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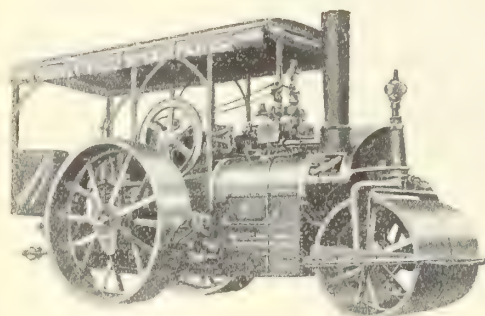
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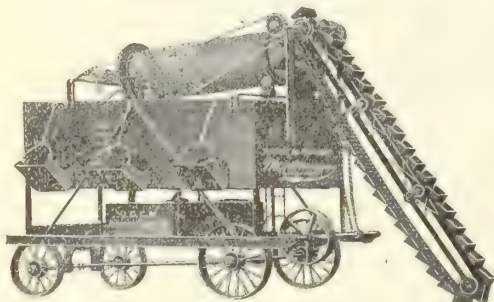
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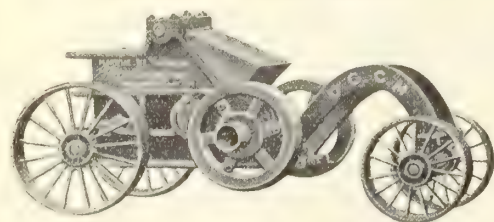
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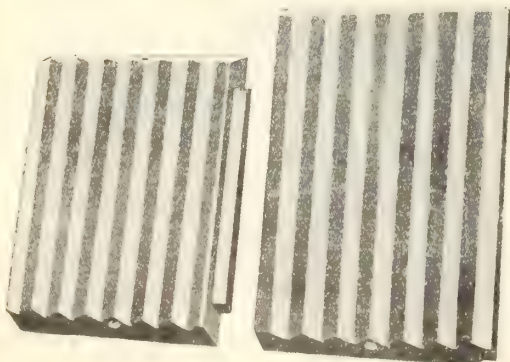
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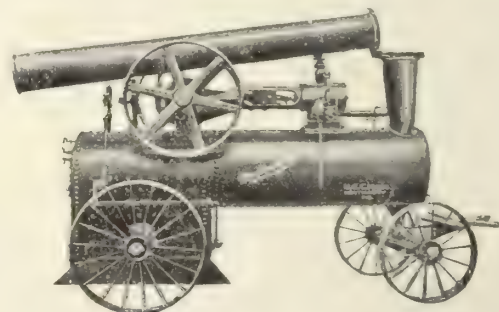
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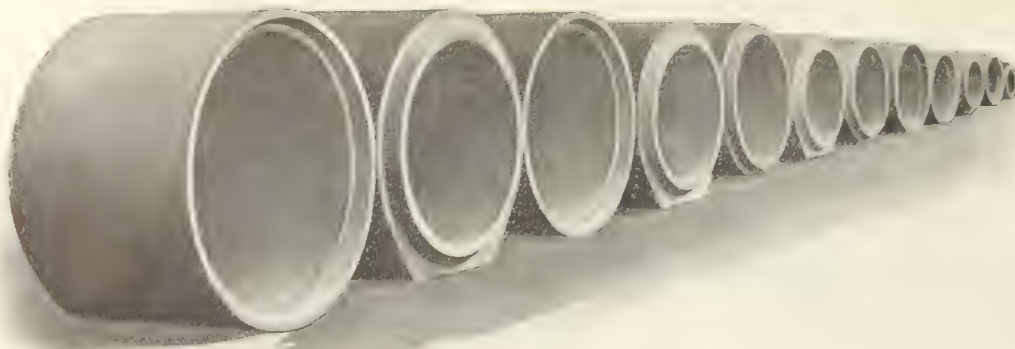
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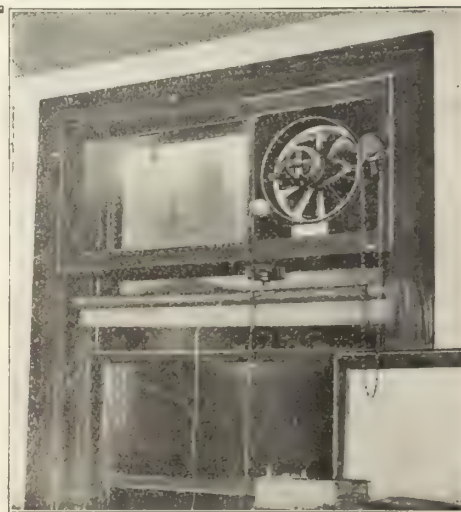
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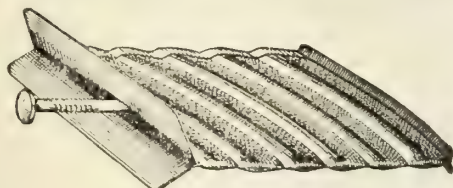
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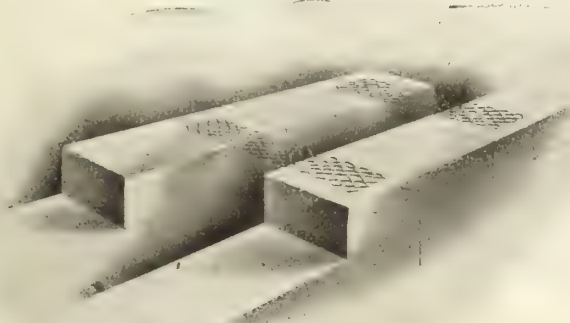
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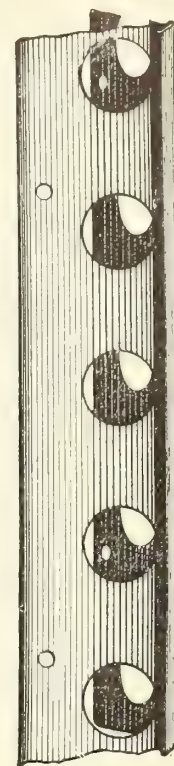
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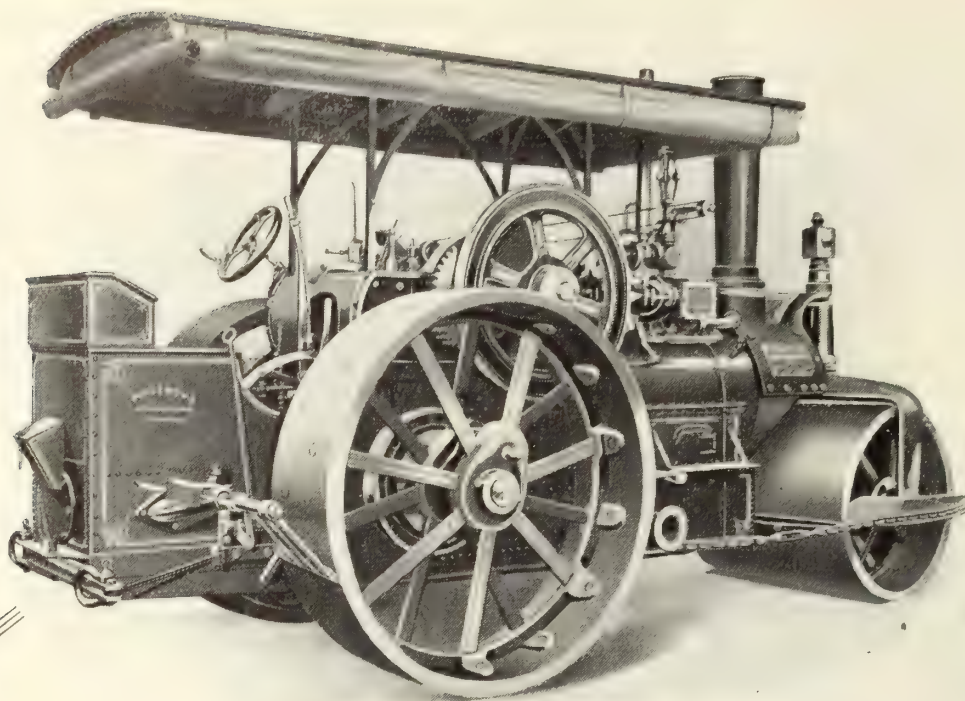
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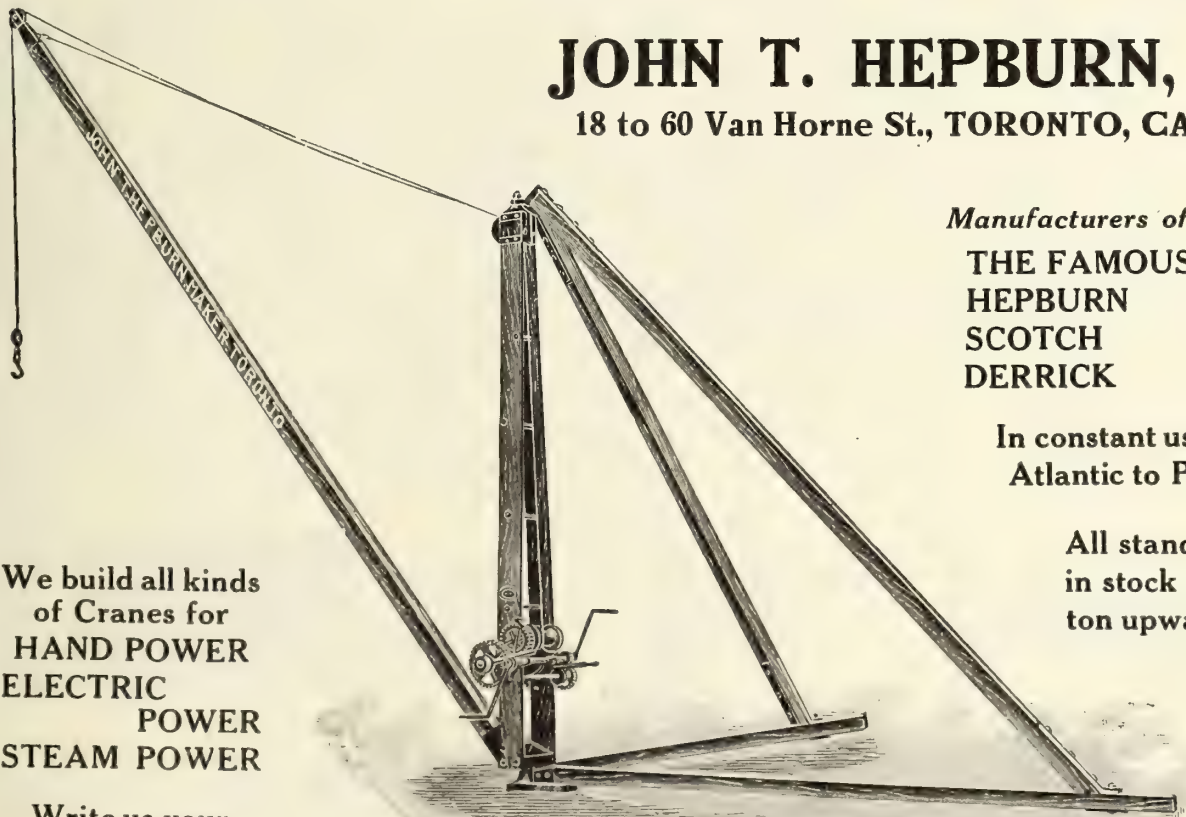
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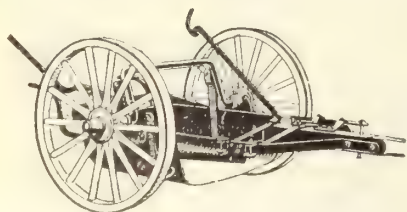
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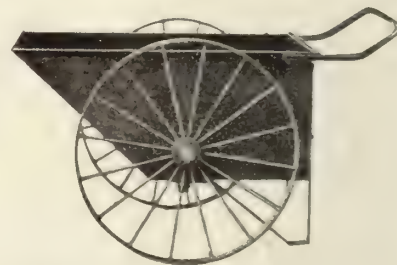
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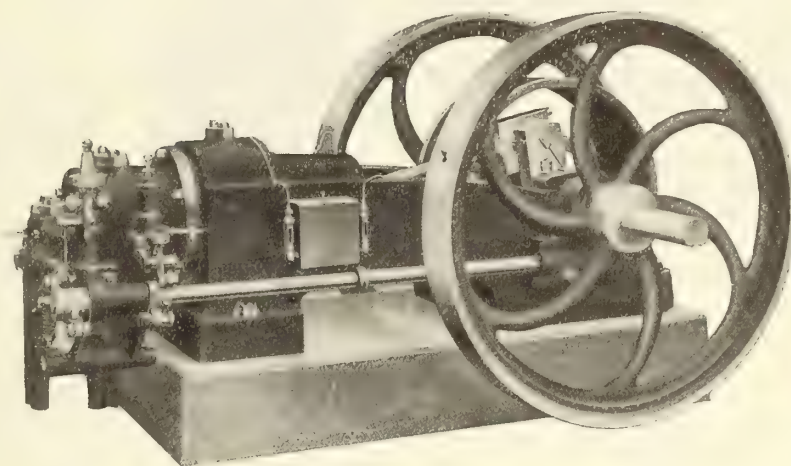
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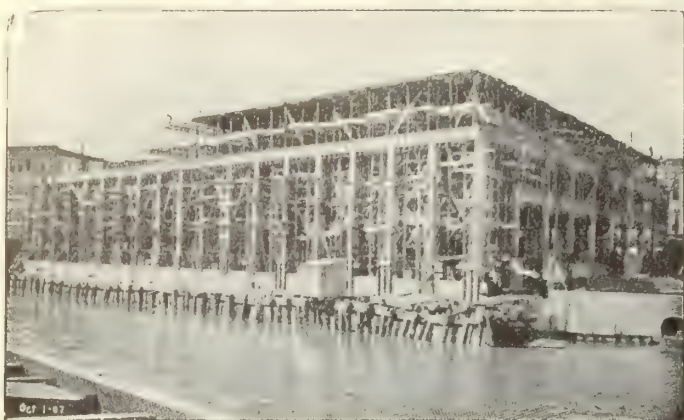
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The Fire Hazard and Its Responsibilities

WITH an investigation in progress at the time of writing, it were un-British to launch into criticism of any of the interests concerned in the tragic fire at the Woodbine Hotel, Toronto, last week, but the occurrence is too serious and too far-reaching in its importance to pass unnoticed. The loss of several lives at an early hour of the evening when there should have been ample opportunity to secure orderly exit from the building demands at least passing mention in a journal which stands for the principle "Safety First" wherever human lives are a factor in the argument. Since the conflagration, the Woodbine Hotel has been criticised as "a jumble of factory and office buildings fashioned into the similitude of a modern hotel." The building has been condemned freely as a "fire-trap," and, in the articles which have appeared in the daily press, reflections have been cast upon nearly everybody except those who were unfortunate enough to be cremated. From the facts which have come to light it may be natural to conclude that the construction of the building could not comply with the requirements of any well-considered, conservative by-law, that the height of the addition to the hotel made last year exceeded that provided for in the city ordinance, and that the facilities for escaping from such a building were inadequate. One is disposed to think these things, but not to pass them on as judgments. Such judgments would be untimely, unjust. Extravagant and gratuitous criticism does not impress a lesson of this kind. It is only by fixing upon the defects, centralizing and amending them, that we can evolve order out of chaos, improvement out of calamity. We are entitled to know—and we must know—under what authority the use of a remodelled factory building of ordinary joist construction was sanctioned for hotel purposes. It is incumbent upon us to ascertain in what respects our legislation requires enlarging so as to make adequate fireproofing and means of rapid exit indispensable in the construction of all buildings of a public character. Efficient inspection must be our watchword. And we must see to it that that inspection is not concentrated upon the sustaining power of the structure, but that it provides protection against that element of fire so destructive of human life—that element which has contributed so much to making the American continent notorious for fire tragedies.

Architecture and Environment

WHILE it may be somewhat beyond the province of this journal to enter into an extended discussion of any particular phase of architecture, it is nevertheless open to us to consider the subject in the general sense of its relation to environment. We are all the more disposed to devote a few thoughts to the subject, having in mind many buildings that have been erected of late in our leading cities—structures which, while generally commendable in their design and equipment, bear little or no evidence of thought in regard to their surroundings.

It may be urged that the problem of adapting a structure to its locality and the neighboring buildings presents peculiar difficulties in Canada. With this we are in accord, but the most superficial examination of the widely varying types of structures in Montreal

Toronto, Winnipeg and Vancouver shows that the question of environment has been almost a negligible factor.

In a recent editorial we commented upon the mistake of hemming in a restricted area such as that enclosed by the four corners of King and Yonge streets, Toronto, with skyscraper buildings twenty storeys high. Several readers took issue with us over our statements, but we cannot but think that they did not give due consideration to the subject of environment. In this conviction we are strengthened by the reading of an address on the subject, delivered recently in London before the Architectural Association, by Professor Perchon, who emphasized the fact that for a building to be really beautiful it must be adapted to its surroundings in regard both to materials and to design. Professor Perchon dealt with the subject chronologically, showing how buildings erected in the various periods had developed on lines suitable to their surroundings, climatic conditions having a most obvious effect. He concluded with the following significant observation:

"Our responsibility is a great one, for, while the influence of ugly and sordid buildings is degrading, and that of a sham, forced architecture is, at the best, ineffective and inoffensive, the influence of a genuine architecture on all who come into contact with it is uplifting and ennobling."

The principle is a sound one. It is one upon which all constructional enterprises should be carried out. Undoubtedly the better we make our public buildings, bridges, streets, parks and houses, the more likely we are to build up a nation. Is it possible to outrage one's senses more violently than to find in the short space of three blocks, on a main street, a dozen buildings all different in height and type and material? In a discussion of Professor Perchon's paper one of those present spoke of "horrible concoctions in red brick" and "dreadful abortions in terra cotta." One cannot help wondering in what terms this man would describe some of our best work of the last decade—work whose sole merit, in most cases, has been individuality in design, but possessing no unity and totally unfitted to its environment.

It may be objected that an outsider has no right to criticize architecture. Such a principle is wrong. Outside influence and criticism have always played a part in all professional work. Too often the architect becomes so highly developed in the artistic sense that he is most deficient in every other. He falls into the most elementary errors in planning and gives no evidences of realizing that the fundamental factors in architecture, as described by the authority mentioned above, are "the proper uses of materials, sound construction, sanitation, and suitability to purpose and surrounding conditions."

B. C. Engineers Active in the Interests of Professional Status

THE British Columbia members of the Canadian Society of Civil Engineers have recently shown considerable activity in endeavoring to get the status of the Engineer recognized by the Provincial Government. In view of much new legislation involving large engineering projects, several influential deputations of the members headed by Mr. F. C. Gamble, Chief Engineer of the Department of Railways, and Mr. G. R. G. Conway, Chief Engineer of the British Columbia Electric Railway Company, Limited, the respective Chairmen of the Victoria and Vancouver Branches, met the Premier, Sir Richard McBride and the Executive Council and laid before them very strongly the views of the Western members.

It was pointed out that in numerous Acts of Parliament, the definition of an Engineer was extremely unsatisfactory. One example given was quoted from the "Ditches and Water Courses Act, 1907" where an Engineer is defined as follows:—

"Engineer" means Civil Engineer. Provincial Land Surveyor, or such a person as any Municipality may deem competent and appoint to carry out the provisions of this Act."

The effect of this definition in one instance in British Columbia was the temporary appointment by resolution of the Municipal Council of a small contractor to design plans, and the deputation pointed out to the Ministers that there was nothing in the Act to prevent a Municipal Council from appointing a gardener, blacksmith or carpenter to carry out the duties of the Act as Engineer.

The deputation were accorded a very sympathetic hearing from the members of the Government, and many private members supported their proposals.

Subsequent to the interviews with the Government, a petition was sent to the Premier signed by every

leading Engineer in the province, asking that the word "Engineer" should be defined in the new Water Act as follows:—

"Engineer means an Engineer of the Water District, who shall be a Civil Engineer who is a member of the Canadian Society of Civil Engineers, or a member of the Institutions of Civil Engineers of Great Britain or of Ireland, or a member of a Civil Engineering Society of equal rank in the British Empire or any foreign country."

This definition was accepted by the Minister of Lands, the Hon. W. R. Ross, who, however, felt that while entirely recognizing the principle of the definition, and in expressing himself in hearty accord with the objections of the members of the Canadian Society, he thought that special circumstances might arise in which he might be hampered by too strict an observance of the definition. He therefore suggested the addition of the following words, a suggestion which was mutually agreed upon, and now, together with the foregoing, forms part of the Water Act of 1914.

"But the foregoing definition shall not limit the power of the Lieutenant-Governor-in-Council or the Minister to appoint to any position created under this Act, any person who is in his opinion competent to fill such position."

The Western members feel that they are to be congratulated upon the success of their efforts, and hope during the next session to have a similar definition incorporated in the Municipal Act, the Railway Act, and other Acts dealing with engineering undertakings.

In discussing the construction of concrete buildings in a paper before the Boston Society of Civil Engineers, Leonard C. Wason, President of the Aberthaw Construction Company, Boston, Mass., advises casting the stairs considerably later than the floors, and in a separate operation.

The Common Sense of Reinforced Concrete Design and Construction

IN an interesting paper devoted to the above subject delivered last month before the members of the Ipswich (Eng.) Engineering Society, Mr. H. E. Steinberg, Assoc. M. Inst. C. E., dealt mainly with the fundamental principles which were common to all systems of design and all types of reinforcement. Owing to the number of so-called inventions with which reinforced concrete was beset, he said it would be most useful if he gave his audience some idea as to how the relative worth of the various methods and designs could be appraised and their practical value judged in one consistent manner. In England practically no experimental work worthy of the name had been done, though a few badly-designed beams and columns had been broken at various times by isolated enthusiasts. He spoke of the disappointment caused by the first Report of the Institution of Civil Engineers, though the second Report contained an account of some ingeniously-planned experiments by Dr. Unwin on plain and reinforced, square and rectangular concrete slabs. In all foreign countries where building was in progress the use of reinforced concrete appeared to be very extensive, especially so in places liable to earthquakes, as the reports of the San Francisco disaster showed that the reinforced buildings withstood both the earthquake and the subsequent fire more satisfactorily than the steel skeleton buildings. With reference to the practical details of construction, he first observed that it was chiefly the cheapness of the material which, other things being equal, had made it so phenomenally successful. He laid it down that if the same unit stresses were specified and worked to by all designers, then the cost of practically all systems must be approximately the same for any particular structure. At the same time he asked them to observe that, though there might be little difference in cost between designs they might vary in merit, either by the actual details of the arrangement of bars, etc., or by the general engineering ability underlying the design. The bending moment in a beam might be calculated accurately for each span and over each support, with all the meticulous niceties of the theory of continuous beams, or, on the other hand, a simple, easy fraction like $WL/10$ might be taken for the bending moment in the span over the supports and anywhere else. In either case the cost of the job would not vary much, but in practice the latter design would develop cracks, whilst the other would have a uniform factor of safety throughout. From this point the lecturer went into still more technical details, in order to explain the common-sense principles underlying all systems of reinforced-concrete design. Amongst the matters alluded to were the extent to which concrete might be safely relied on to stick to steel so that they could arrange for their reinforcement to have sufficient superficial surface, in proportion to the cross-sectional area; of how to increase points of weakness by widening the beam by embedding reinforcement, or by increasing the depth of the beam. It was a simple matter to say that this part would be in tension, that in compression, and that the other was trying to slide relatively to another part; but it was not so easy to determine how many tons' tension there might be there, how many pounds' compression there, and exactly to what extent one portion of the concrete was sharing in respect to another. These, however, were the problems which must be solved by every designer, and the merit would

depend on the accuracy of the various solutions. After showing the advantage of reinforcing by spiral and other methods, he concluded by saying that the future would be with the specialist designing firms, with a greater tendency to specify a system of design so that the firms would be able to lower their fees. The largest amount of work would accrue to those firms whose reputation was the best for turning out designs accurately, clearly, and quickly.

Electrical Driving of Winding Engines and Rolling Mills

At the last meeting of the Canadian Society of Civil Engineers, Montreal, Mr. C. A. Ablett, A. M. Inst. C. E., Manager of the Siemens Company of Canada, Limited, and Mr. H. M. Lyons, A. M. I. E. E., presented a paper on the above subject. The paper dealt in a comprehensive manner with electrical machinery for driving hoisting machines and reversing rolling mill plants in steel works, and described the Ward Leonard and Ilgner systems. The various safety devices were also described, the authors expressing the opinion that the Ward Leonard or Ilgner system of electric winding is the most suitable for vertical shafts and for all cases where large outputs are required and short and frequent winds are made. The three-phase winder always has the disadvantage that it cannot be so completely protected against careless handling as either the Ward Leonard or the Ilgner, but it may prove more economical for long slopes where the full speed run is a long one and the periods of acceleration are comparatively infrequent. Direct current is much better adapted for driving mills and machinery in a steel works than three-phase current. Where large reversing rolling mills are driven electrically, and the motor driving the motor generator set is supplied from a direct current system, it is found that the power supplied to the rolling mill plant can be maintained at a much steadier value than if it is supplied from a three-phase system, and with the direct current motor about a ten per cent. saving in power can be effected, as there is no loss of power in slip resistances.

In a paper read to the American Society of Mechanical Engineers, Mr. G. E. Fisher, of the Arkwright Fire Insurance Company, says that the best fire-resisting materials for concrete are usually considered to be first-class Portland cement, with quartz sand and broken trap rock. Cinders make a good aggregate for fire resistance; but the concrete made with them is not so strong as rock concrete, and cannot be used where high compressive values are necessary. Considered from an insurance point of view, cinder concrete is not desirable, on account of the porous quality of cinders. The insurance companies have learned that with cinder concrete they are called upon to pay losses on account of damage from water used at times of fire, which percolates through the small interstices of the cinders (which the cement mixture cannot reach) to the floors below.

President Wilson has signed the bill authorizing the expenditure of \$35,000,000 for the first government-owned railway constructed for the United States. The President said that the enactment of the railway bill would be followed by the passage of the Alaska leasing bill, which would mean the carrying out of the administration programme for the development of Alaska in a short time.

Concrete in Irrigation Work in the Okanagan Valley, B.C.

By B. P. Little, C.E., Manager B. P. Little Construction Company, Limited, Kelowna, B.C.

THE irrigation works of the South Kelowna Land Company, Limited, of Kelowna, B.C., contain many points of constructional interest. The article presented herewith is devoted primarily to a description of concrete-lined canals and concrete pipe laterals, the latter being under heads ranging from zero to 140 ft.

General Scheme of Layout

The system was planned by and the work executed under the direction of Mr. F. W. Groves, C.E., B.C.L.S., Chief Engineer for the South Kelowna Land Company. The land to be irrigated embraces a tract of irregular outline containing about 4,000 acres lying on the east side of and overlooking Okanagan Lake,

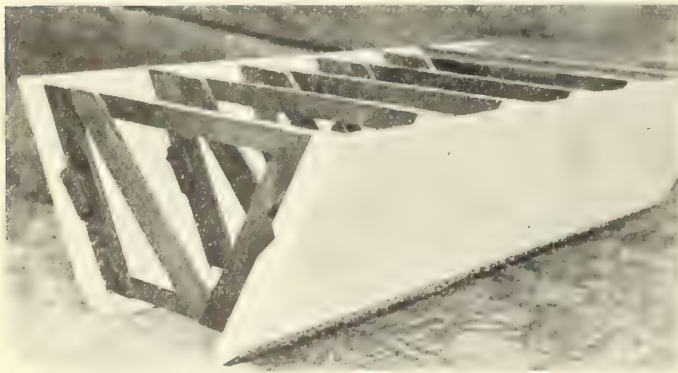


Fig. 1.—Forms for canal lining assembled.

and is situated in the famous Okanagan Fruit Belt. The water for the system is conserved in a natural basin lying on the height of land between the Kettle River and Okanagan Valleys, at an altitude of 4,170 feet. The storage of water is accomplished by constructing four earth-fill dams across as many outlets to the basin, two of which have already been built. The others will be added from time to time as additional storage becomes necessary. The ultimate storage will amount to 10,658 acre feet, about one-third of which is now available.

The principal dam, No. 2, is situated about sixteen miles easterly of the centre of the tract to be irrigated and is approximately 600 feet long on top and will be 34 feet high at centre. It is now 24 feet high. The top width will be 16 feet, with inside slope of 1 on $2\frac{1}{2}$, and outside slope of 1 on 3, with a puddle core averaging 6 feet in thickness. The main sluice-way is a concrete conduit, reinforced with triangle wire mesh. The flow is controlled by iron gates from a reinforced concrete gate tower. The spillway is located near another dam (No. 3) about a mile distant from Dam No. 2 and will be a concrete-lined raceway discharging on to rock.

From the main dam the water flows westward in the channel of Hydraulic Creek, a distance of twelve miles, more or less, to a small concrete intake dam located in a deep rocky gorge, bedded and buttressed on solid rock. This intake dam forms the headworks of the distribution system. From this headworks to

the rim of the Canyon the water is conducted through a wood stave pipe 32 in. in diameter for 3,800 feet, the maximum head on pipe being 132 feet. At the end of the wood stave pipe begins the canals and the concrete pipe system which is the particular subject of this article.

Section No. 1 of the main canal begins at the end of wood pipe and extends westward a distance of about three miles to the crossing of Canyon Creek. This portion of the canal is located on very difficult ground, along the faces of almost vertical cliffs, steep bluffs of cemented gravel and clay and other difficult features. Access to the line of canal with vehicles was only possible at distant intervals and then only at a heavy expense for "tote" road building.

The canal has a calculated discharge of 75 sec. ft. on a grade of 0.15 per cent., the finished dimensions being 3 ft. wide on bottom, 3 feet deep, with side slopes of $\frac{1}{2}$ on 1, making a top width of 6 ft. The canal is lined throughout with 3 in. of concrete. Canada Portland Cement was used for all concrete work described herein. Careful computations were made of various sections for this canal to determine the most economical shape of cross-section, and it was found that the best section was to make the depth and bottom width equal, with side slopes of $\frac{1}{2}$ on 1, considering the cost of excavation, cost of concrete lining per cu. yd., and the mean hydraulic radius.

Soil Conditions

The ground traversed by Section 1 of the canal having been described, in a general way it may be said that this description applies as well to Section 2, except that the land is less precipitous. Below Section 2 and over the whole tract the soil consists of light sandy loam, with some gravel admixed in places. The rock along the upper reaches of the canal is greatly shattered and seamed, and the clay bluffs when saturated are very unstable, so it was early decided that the canals should have impervious linings, not only to prevent great waste of water by percolation, but to preserve the integrity of the canals.

The Provincial Water Commission allows $2\frac{1}{2}$ acre feet per acre per season for this district, measured at the head gate, and any considerable loss of water would be inadmissible. Consideration was given, too, to the deleterious effect of escaping water upon the



Fig. 2.—Forms for canal lining knocked down.

lands lying below the ditch lines. This water usually travels below the surface as ground water dissolving the alkaline salts from the earth in passing, until the water finally rises to the surface and evaporates, leaving behind the salts to form "alkali" and destroy the fertility of the land. With an ingenuity that seems devilish, this water almost invariably selects the most fertile bottom land or most highly-cultivated field in which to make the deposit, and the best land is soon



Fig. 3.—Canal two years after construction.

useless. This danger to the land is a most insidious one that may not be recognised (probably will not be by the uninitiated) until too late to rehabilitate the soil. This trouble from percolating water has become so pronounced under some of the older U. S. irrigation systems, and in one, at least, of the Okanagan Valley systems, that owners of damaged lands are either threatening or have started damage suits. It is probable that state and provincial laws will take cognizance of this evil some time and require that all irrigation water ways shall have impervious linings, but probably not until a few more million dollars' worth of damage has been done.

The crossing of Canyon Creek is made with a riveted steel pipe inverted syphon, with a mean diameter of 28 in. and about 2,000 feet long. The canyon at this point is a rocky gorge about 375 feet deep and 1,200 feet wide from rim to rim, but the syphon does not cross it directly at right angle with its direction. The maximum head on the steel pipe is approximately 360 feet.

Section 2 of the main canal extends from the syphon westward for about 4,500 feet, where a drop of 350 feet is made to a lower level by means of a 24 in. concrete pipe, 2,600 feet long, to Section 3 of the canal. At this point advantage was taken of a natural depression in the ground to form a small reservoir for "balancing" the flow in the canal. This reservoir forms the headwork of lateral No. 2. It has a capacity of about 6 acre feet.

Section No. 3 of the canal extends westward from the foot of the above-mentioned "downtake," a distance of about 1 mile. It will be extended several miles further as required. From this section the lateral distribution is made. This will ultimately consist of seven laterals with a combined length of approximately 150,000 feet, or about 28½ miles.

The topography of the tract is such that open ditches and flumes would require indirect routes and

extensive trestling, involving high maintenance charges, attendant loss of water and damage to land. Therefore, pipe lines, following closely the undulations of the ground and taking the most direct courses between objective points, were selected as the economical solution. Wood, steel and concrete pipes were considered and costs estimated, and the selection fell on the last-named. Wood pipe gave the lowest estimate of first cost, but its life for irrigation work in the Okanagan Valley is proving to be very short, probably not to exceed nine or ten years, although no exact average figures are available yet. This failure is owing to dry rot, probably due to the pipes being empty from seven to eight months in the year, and in a few instances by the wire wrapping corroding.

Steel pipe does not differ much from concrete pipe in first cost, but it promises to be short-lived. All the irrigation water used in the district is very severe on steel or iron, this being attributable to carbonic acid gas arising from the oxidation of the vegetable matter in the swamps at its source. No paint or coating, thus far, has been able to prevent this water from pitting and corroding the steel of pipes or the castings of gates, valves, etc. From present indications it is very doubtful if the life of steel pipe will exceed that of wood pipe in the same service.

Concrete in various forms has been used in irrigation works in the Kelowna district for a number of years—antedating either wood or steel pipe. No signs of disintegration have become visible, and no doubt of its suitability or permanence has been felt. Concrete pipe was therefore adopted in this instance for the distribution system.

Details of Construction

The main canals were excavated as nearly as possible to the exact outside dimensions of the concrete lining, but were generally from 0.1 to 0.2 feet larger in width. Great care was taken to get the bottom dressed precisely to grade. This was accomplished by keeping the bottom 2 or 3 inches high in the first excavation and doing the final dressing after the bottom grade hubs had been set, as described below.

The alignment of canals was such that the entire bottom was in solid earth as far as practicable. To



Fig. 4.—Canal showing curve alignment—two years old.

make the cut and fill balance it generally required a cut of 7 of 8-tenths of a foot at the lower side of the bottom. Considerable refinement was given the location so that the excavation of the ditch, a berm two feet wide on upper side and the side hill slope excavated above berm would just build the fill, with a berm of 2 feet on the lower side of ditch. The excavation was nearly all made with pick and shovel, drag scrapers and ploughs being used in only a few places, and then

with no gain in economy. The alignment consists of tangents and circular curves run in with a transit. After the rough excavation was made, the centre lines of tangents were re-run and curve points re-established, but around the curves the concreting was allowed to follow the excavation as first made. Grade hubs, with tops driven to the finished top of cement lining, were set every 15 feet on both tangents and curves, and the final dressing of bottom was then made by measuring down 3 in. from the top of stake. These hubs remained as a guide to the form setters.

Forms

Forms for the canal lining, designed by the writer, were of a "knock-down" type and are shown assembled in Fig. 1 and knocked down in Fig. 2. They were built



Fig. 5.—Use of air compressor for tamping concrete in pipe moulds.

in sections from 6 ft. to 12 ft. long, each section consisting of two sides and a number of cross frames spaced 2 ft. apart. The sides were made of $\frac{7}{8}$ x 4-inch matched pine flooring, nailed to 2 x 4 studs on 2-ft. centres. The cross frames were made of 2 x 4 stuff with 1 x 6 in. bracing. The lower cross bar was kept 4 in. in clear above the bottom of finished concrete, to allow trowelling under the cross frames. These cross-bars proved rather light, and would have been better made of 2 x 6 in. scantling; still, after two seasons' work these forms are very serviceable and will be used in extending the main canal. There were built 1,400 lineal feet of these forms, the cost being \$1.15 per foot, with lumber at \$20 for the sized material and \$28 for matched flooring, carpenters at 40c an hour. The exterior surfaces were coated from time to time with California crude oil, to prevent the concrete from adhering.

After the forms were distributed along the berm, a gang of four men were able to assemble and line up 500 feet of forms per 10-hour day. The procedure was for two men on the berm to hand the parts down to two men in the excavation, who assembled the forms. Then the assembled forms were aligned and blocked up to grade and each was attached to the last preceding form with two bolts, one on each side, to prevent end motion. On curves a strip of galvanized sheet steel was placed over the opening between the adjoin-

ing forms, as they would touch only at the top on the inside of the curve. The construction of these forms is shown quite clearly in Fig. 2. There were hardwood pins in the top and bottom of each stud projecting $\frac{3}{4}$ -inch from the side of the stud, and mortices in the ends of the cross bars that engaged these pins, and a hardwood button on the side rib of the cross frame that entered a notch cut in the side of the stud. When assembled the forms were rigid and each complete form could be handled as a unit.

Outside of the forms, between the forms and the side of the excavation, battens of $1\frac{1}{2}$ x 3 in. pine were stood up at about 18 in. centres, and outside of the battens were placed sheets of 10-gauge steel, about 3 x 4 feet in size. When the concrete of side lining was being placed, the sheets were pried up against the battens and earth was tamped in between the sheet and side of excavation at the same time as the concrete was being rammed between the battens, the battens and steel sheet being raised as the filling advanced, so that when the space was full the battens and sheets were fully removed and ready to use again. This gauged the thickness of just 3 in. of concrete, and also prevented the concrete tampers from mixing earth with the concrete. The only objection to this arrangement was that the earth back of the sheet could not be rammed as hard as it should be without raising the forms (even when loaded with the concreting paraphernalia and several men) and the filling had to be gone over again the following spring and retamped. It was found that this filling had become so slack in places that the side lining had settled outwards, causing incipient cracks, but after a thorough retamping no further trouble was experienced. Sections 1 and 2 were placed in 1911.

When placing the lining the concrete was wheeled in barrows from the mixer on planks laid on the tops of cross frames of forms. The bottom was put in first, and a workman floated this up to the surface and trowelled it. As soon as the bottom was in, the sides were concreted. To do this, the wheel barrows were dumped on a steel plate on the plank runway, and the material was shovelled into the space between the battens. The lining was divided into sections of about 15 feet by placing strips of thin sheet iron, 3 in. wide, on edge across the bottom and up the sides. These strips were left in and formed contraction joints. The blocking under the forms was removed as the concrete bottom was put in. The forms were allowed to remain for twenty-four hours, when a gang of four to six men knocked them apart and passed them out onto the berm, then patched any rough or broken places in the

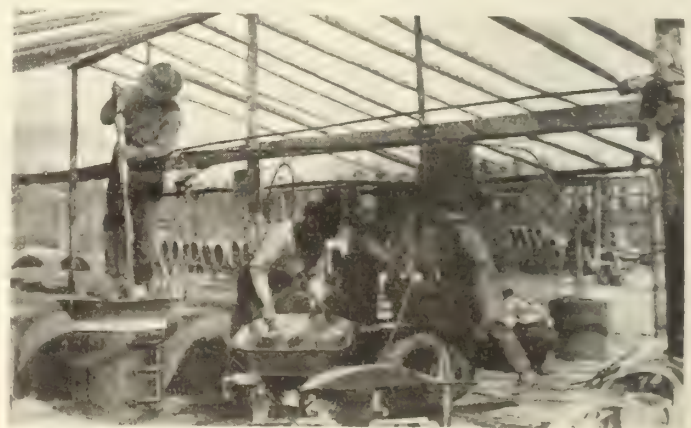


Fig. 6.—Framework of sheds in pipe yards.

concrete and finally gave it a brush coat of cement grout. The lining was then covered with burlap and sprinkled occasionally for the remainder of the day. The following day the burlap would be moved ahead, a temporary bulkhead of plank placed at the lower end of the completed section and the bulkhead at the foot of the preceding day's work removed or holes bored in it, and the ditch allowed to fill with water. One or more times during the day, and possibly the following day, a man would go along the berm and splash the water up to the top of the concrete, but after the second day little attention was paid to it, the capillary attraction being sufficient to keep the top of the concrete wet.

As the finishers removed the forms, a gang of laborers carried them ahead to the form setters, except where a wagon could approach the canal, when they were transported in that way. Water for mixing was raised from behind the bulkhead with a small gasoline pumping engine and was sent forward to the mixer through 2 in. wood pipe, which was taken up behind and relaid ahead as occasion demanded. A gang of forty men in all could average about 400 feet of lining a day, with now and then a spurt of over 500 feet. The latter figure corresponds with an output of 50 cu. yds. a day, as the cross-section of the concrete is 2.7 sq. ft., or 1/10 cu. yd. per foot.

The concrete was 1:3:6 mixture, using 10 per cent. of hydrated lime, and gravel aggregate, mixed in a drum batch mixer. The cost of lining was from \$15 to \$18, the cement costing about \$4.50 per bbl. delivered at the ditch. The high cost of concrete is due principally to the difficulties encountered in getting material distributed, including cost of "tote roads."

Observations as to Durability After Two Years

As noted elsewhere, the first and second sections were lined in 1911 and are now over two years in place, and it is possible to draw some conclusions as to the durability of this lining, cost of maintenance, etc. The following important repairs have been made. The earth along the side lining has been retamped over a large portion of Sections No. 1 and 2 and to a lesser extent on Section 3.

About 60 feet on one side of Section 1 was wrecked in the spring of 1912 by a mud-slide. The side lining happened to project an inch or more above the berm and when a heavy clay bank above it, slid, it caught this exposed edge and turned the side over into the canal. No harm was done to the bottom or opposite side. The bottom heaved up and had to be replaced for a distance of several hundred feet on Section 2 during the winter or spring of 1912. This portion of the ditch was through a thorough-cut in hardpan. The old bottom was cut out, drain tile laid in a trench excavated below the bottom, covered with gravel and a new bottom put in. The drain tile extended out of the cut and was carried out to the surface down the hill from the canal. Some further repairs were necessary the following spring (1913) some cracks developing that were plastered over. This cut will probably require annual repairs if the lining is to be kept intact, but owing to the imperviousness of the soil there it would hardly seem necessary to try and keep this particular cut up to standard maintenance.

In addition to the above, some cracks have been grouted and berms levelled up to top of concrete, etc.—mostly done at odd times by the ditch walkers. Excepting the clay cut there are no defects that indicate that the lining will not last for years. The annual

maintenance will be practically nil. Those portions of the ditch that are located wholly or almost all on rock fills show the fewest defects. The portions that are partly on fill are in the next best condition, and so on until the poorest parts are in full cut sections in heavy earth. This of course is due to the under-drainage where location is on fill or mostly fill. If thorough cuts in heavy earth are necessary it would be better to construct a closed pipe or conduit, which could be back-filled, and by closing the ends of this section with boards or brush and leaves in the fall the frost could be kept out from below the bottom. Figs. 3 and 4 shows views of the canal at the age of two years. The photographs were taken when about 1-inch of water was running in the ditch.

Lateral System of Concrete Pipe

As noted elsewhere, the lateral system is constructed of concrete pipe and will eventually embrace about 150,000 lin. feet of pipe, about half of which has already been supplied.

The general specifications for the pipe with unit working stress for unreinforced pipe, and the unit



Fig. 7.—Completed pipes.

stress in steel in reinforced pipe were worked out by the engineer and the contract for its construction given to the B. P. Little Construction Company, Limited, of Kelowna, who designed the details and methods of manufacture.

The pipe for lateral No. 5, with a length of approximately 35,000 feet, was installed in 1912 and the spring of 1913. The trenches were excavated and the pipe made for lateral No. 2 in 1913, but the pipe has not yet been laid in place. The pipes range from 6 in. to 30 in. in size, and are all made in sections 2 feet long, with bevel and tongue joint.

The plant for the manufacture of the pipe consisted, in addition to the usual steel pipe moulds and cast iron rings, of a 20 h.p. gasoline engine belted to an 8 in. x 8 in. air compressor, with 24 in. x 6 ft. receiver, six compressed air concrete rammers, one compressed air chipper, power driven punch and shear and power driven bending rolls, batch mixer, screens, etc.

A pipe yard about 150 x 350 feet was nicely levelled off and a rough framework of poles was put up as shown in Figures 5 to 10. Three "sheds" were erected of these poles, each 30 x 300 ft., with driveways along each side of each shed. A one-inch water line under 50 lbs. pressure and a 3/4-in. air line under 80 lbs. pressure was placed along the centre of each shed, each pipe line being provided with hose tape every 30 to 40 feet.

Each pipe-making gang working in these sheds

was provided with a canvas cover of 10 oz. duck, 24 x 40 feet in size, which was stretched over the framework, and under which they worked, thus protecting the fresh concrete and newly made pipe from the sun. As the gangs advanced through the sheds the canvas was moved forward.

As soon as the pipe would stand wetting, without washing away, they were sprinkled, and an expert waterman could begin giving them water within a half hour after the moulds were withdrawn. In warm weather a spray could be kept on them after they were three or four hours old. As soon as the pipes reached this set sprays from garden sprinklers were kept on them and they were not allowed to become dry again until cured—a matter of twelve or fifteen days, depending on the weather. Dozens of these sprinklers were in use all the time. One man devoted all his time to their attention, with an assistant about half the time.

The pipe was specified to be made of a 1:2:2 mix, using gravel aggregate, not larger than one-half the thickness of the shell of pipe, with the addition to the cement of twelve per cent. of its weight of hydrated lime. For some portions of the pipe a 1:1½:1 mix was used, as in the reinforced pipe of small diameter the shell was so thin that the gravel had to be very small



Fig. 8.—Concrete mixer used in manufacturing pipes.

to pass the reinforcement—in fact a mixture of 1 cement to 2½ sand better expresses the composition.

The mixture was turned over dry for one minute in a batch mixer (Fig. 8) and then water was added to bring the total moisture up to about 18 to 19 per cent. of the weight of cement. Dry sand was preferred as it gave a more uniformly dry mix, and it was generally possible to keep the sand practically dry. The resulting batch with the above amount of water would just stay up in a ball when patted together in the hands, but under the power rammers moisture would be forced out of it and deposited as a heavy dew on the walls of the moulds. The endeavor was to have the mix as wet as it could be made to stand up when the moulds were withdrawn immediately after forming the pipe. With reinforcement a considerably wetter mixture was possible.

Under 80 lbs. air pressure at the receiver the rammers ran at a speed of about 400 blows a minute, with air cylinders 1¼ x 5 in., the usual stroke being about 4 inches. As near as could be determined there was about 40 lbs. average effective pressure in the machine. The weight of moving parts was approximately 8 lbs., the momentum of which was effective in adding to the force of the blow. The combined ramming effect may

be estimated at about 92,000 inch-lbs. per minute. The resulting pipe was dense and homogeneous, the unreinforced pipe weighing at the rate of 148 lbs. per cu. ft. of concrete, for smaller sizes to 152 lbs. per cu. ft. of concrete for larger pipe. Ordinary wet-mixed concrete of the same material ran about 142 lbs. per cu. ft. The freshly moulded pipes were allowed to remain standing undisturbed on the cast iron ring forming the bottom of the mould for a period of from twelve to thirty hours (sometimes longer) depending on the weather; then they were turned down on their sides and the rings removed.

The pipes were allowed to lie in that position, under sprays of water, for several days, or until the space occupied was again required for moulding, when they were "corded" up along the driveways until curing was complete. Then they were hauled out to the trenches. There were nine sizes of pipe and three to five "classes" of each, the class referring to the amount of reinforcement, there being 34 varieties in sizes and classes altogether. To prevent any possible confusion, each piece of pipe was marked, soon after it was made, with the date and class, using lampblack mixed in kerosene oil. These markings remain perfectly legible after eighteen months' exposure to the weather. Fig. 9 shows 30 in. pipe standing on a ring, and Fig. 10 the same pipe turned down and the ring removed.

Unit Stresses and Reinforcement

The maximum static head allowed on unreinforced pipe, referred to as "plain" pipe herein, was that due to a tensile stress of 60 lbs. per square inch. This stress, however, occurs but in a few places on small pipe. The more usual limit strain was 40 lbs. per sq. in.

Reinforced pipe was used where the stress would exceed 40 lbs. per sq. in. in the concrete (except in a few instances as noted) and the reinforcement was figured to take all the strain at a factor of 8,000 lbs. per sq. in. This low factor was used for the following reason: The steel is placed in the shell of the pipe simultaneously with the concrete. The concrete in curing will shrink somewhat and the hoop is thereby put under compression. With a wet mix this shrinkage is considerable, and with the moist mixture described above as used on this job the shrinkage is perceptible. When pressure comes on the inside of the pipe the concrete must "give" either by its elasticity or by the development of hair cracks before the steel will begin to take strain in tension. If the stress on the steel were sufficient to stretch it appreciably a leaky pipe would be expected. Take for instance a 20-in. pipe with hoops 22-in. in diameter; the extension in circumference of the steel at 8,000 lbs. per sq. in. would be almost exactly 1-64 of an inch, which would probably be divided between several hair cracks around the circumference of the shell. These cracks would not open enough to leak, but if the yield were much more than that amount the cracks might become more than "hair cracks." As a matter of fact it was found in testing reinforced pipe in the testing machine in the yard that if the pipe had become well dried out, and the pressure were run up immediately, the test piece would crack from end to end at about the breaking strain of plain pipe, but after a few minutes this crack would cease to leak and the full test pressure could then be put on gradually. If the water were allowed to stand in the pipe for a time, as over night, before the pressure were run up, it would then test well above working pressure without cracking at all, the explanation being that the concrete would "swell" or expand enough to put an initial stress on

the hoops. The testing outfit was rather crude and in the writer's opinion the results obtained from it were not dependable. It might be misleading to publish the figures, but from the tests the conclusion was drawn that at from 10,000 to 11,000 lbs. per sq. in. stress in the steel, the concrete would begin to show hair cracks, although these would not often leak until 11,000 lbs. was exceeded.

The testing machine consisted of bulkheads with rubber gaskets placed over the ends of the pipe, drawn together with through rods parallel with and outside of the pipe. In order to prevent leakage at the gaskets, it was necessary to draw these rods very tight. There was no way of estimating this end pressure, or of ascertaining its effect, but it was found that other things being equal (apparently) the tighter the bolts were drawn the lower would be the bursting pressure. In a number of instances the pipes burst in trying to get the bulkheads tight, before there was any internal pressure that would register on the ordinary steam gauge used, this referring to plain pipe only.

The reinforcement consists of flat bands of open hearth steel, ranging in section from $\frac{1}{8} \times \frac{3}{8}$ to $\frac{1}{4} \times 1\frac{1}{4}$ inches. The hoops were sheared to length and punched for rivets in a combination punch and shear driven by a 3 h.p. gasoline engine, and rolled to proper circle in a $4\frac{1}{2}$ in. set of rolls driven by the same engine. Two or more rivets were driven in each hoop, spaced 1 in. apart, one behind the other on the centre line of the hoop band. Rivet shear was taken at a maximum of 10,000 lbs. and the section of steel in hoop at rivet hole not to exceed 16,000 lbs. per sq. in.

As the hoops were rivetted they were made up into bundles each containing just the number of hoops required for a two-foot section of pipe. This guarded against the moulders inserting a wrong number in any one section. A quantity of these hoops made up and bundled are shown in Fig. 11.

The longitudinals were made up of the same steel stock, two or four to each section of pipe, proportioned to size and head, with a return bend on each end. The ends of these bars are shown in the pipe illustrated in Figs. 9 and 10. The moulds were provided with clips, which held the longitudinals in place during the moulding, and the longitudinals were placed inside of the hoops and served to hold the latter concentric with the shell. The hoops were spaced by means of gauges and no trouble was experienced in getting them in their proper positions. The standard construction called for three hoops per foot, varied in a few instances. The pipe yard force consisted of about forty men and turned out from 500 to 1,350 feet of pipe a day, depending on the proportions of plain and reinforced pipe made.

Pipe Laying

The trenches were graded so that the drainage of the pipe to frost taps was provided for, the standard practice being to sink the pipe so as to have not less than 18 in. of cover over it to the surface of the ground. This required quite deep cuts in places, through knolls and swells in the surface of the ground. The excavations were well made, straight, and of good finish to bottom. The contractor was not required to lay the pipe to line, either for grade or alignment. This greatly reduced the cost of the installation.

Pipe from 6 in. to 12 in. bore was laid by a gang of two men, 1 mixer and 1 layer; 14 in. and 16 in. pipe was laid by a gang of three men, and larger pipe by gangs of 4 to 6 men. It was not found economical to use tackle for handling pipe up to and including 24 in. which weighed 200 lbs. per foot. The ends of all pipes



Fig. 9.—30-inch pipes standing on rings.

were cleaned with a stiff wire brush to remove the "laitance" and any adhering earth. They were then wetted and the bevel end "battered" with neat cement, while the pipe was standing upright. The pipe was then turned down and the bevel shoved over the spigot end of the pipe previously laid, and the joint completed with 1:1 cement mortar, a collar, 3 to 4 inches wide by from $\frac{1}{2}$ to $\frac{3}{4}$ inches thick being trowelled around the pipe over the joint.

Two methods of joining the longitudinal bars of the reinforced pipe were used. The first was by means of clips formed of short pieces of band steel of the same thickness as the connecting longitudinal but $\frac{1}{4}$ in. wider. These clips had a return bend on each end similar to the bends on the longitudinals with which they engaged. The second method was by means of No. 12 steel wire, by wrapping sufficient turns of the wire in the hooked ends of the adjoining longitudinals to make the area of the wire slightly exceed the area of the longitudinals.

Both connections proved adequate, but the wiring was preferred as each turn could be brought taut as put on and the strain placed equally on all longitudinals, while with any form of clip or connection that was made up in advance in the shop there would be a slackness in the connection of some of the longitudinals where the axial directions of the pipe was not perfectly straight, and as noted above, the grade line was undulating. The wiring methods proved a little more expensive than the clips, but it was used for the greater portion of the reinforced pipe. Neat cement "batter" was worked in and around the wiring and the whole connection covered by the collar.

That the longitudinal reinforcement has great



Fig. 10.—30-inch pipes completed.

strength is shown by the following incident. A section of 20 in. pipe, to work under 60 feet head, crossed a piece of swampy ground for a distance of about 70 feet. Efforts were made to get a sufficiently firm foundation for the pipe, but when the line was filled with water a number of leaks were found at this point, assumed to be due to settlement of the pipe. The water was drawn out and efforts were made to close the leaks on the outside of the pipe, but owing to the mud and water of the swamp a satisfactory job could not be done. It was then decided to cut out a section (2 ft.) of the pipe and make the repairs on the inside. This opening was made at a point beyond the swamp, about 7 or 8 feet higher than the lowest point, where the trench was in sand and gravel, this point being chosen for the easy excavation. At night, while the pipe was open, a violent rainstorm occurred, and sufficient surface water ran into the canal to cause a flood of water to come down the pipe line and flow out at this opening. The water then flowed back to the low ground outside of the pipe, washing away the backfill and undermining the end of the pipe for a distance of 10 feet. The longitudinal reinforcement held up this length of pipe and its load of water, the action being that of a cantilever. Examination the next morning showed a crack (extending about one-half the circumference) in the joint over the point of support,



Fig. 11.—Hoops used in reinforcing pipes.

and a similar crack about 6 in. back in the pipe from the cracked joint, and the unsupported end had settled down about 0.1 ft. below grade. This end of the pipe was jacked up to grade, the cracks chipped open and pointed with cement, and the intended repairs made through the swamp and the line closed up.

The grade of the pipe where the washout occurred is plus 12 per cent., which would mean a depth of 1.2 feet of water over the point of support when the water just overflowed the open end. As it flowed in sufficient volume to wash away 8 or 10 cu. yds. of earth in less than an hour, there was evidently a good-sized stream running.

When laying pipe of 20 in. bore and larger, the joint was pointed and smoothed on the inside. For smaller sizes a bag filled with hay was drawn through, keeping the bag three or four joints behind the layers. The appearance of a completed line is shown in Fig. 13, which also shows a standpipe in the distance. In some cases the pipe lines were covered 3 or 4 inches deep with backfill as soon as laid; in others they were left entirely open until after testing, in which case the top of the collar was covered with a few trowels full of sand, as shown in Fig. 13.

Whether the pipes are covered immediately depends, of course, on the kind of weather and the length

of time that will probably elapse before the testing. If left exposed to alternate sunshine and cold nights the pipe will crack circumferentially at intervals, but a collar can be put around these breaks just before testing with very little labor, and the advantage in having the pipe entirely exposed for inspection during the testing more than pays for the extra trouble.

Expansion Joints

These were inserted where the pipe lines entered distribution boxes, stand pipes, and where branch connections were made, but the type of expansion joint adopted proved to be of little value, and under the pressures used gave trouble by blowing out and leaking. The joint consisted of a reinforced concrete sleeve from 8 to 12 inches long, according to the size of pipe, cemented to one section of pipe and surrounding the other, leaving an annular space of from $\frac{1}{2}$ to $\frac{3}{4}$ -inch, this space being run full of melted asphalt. The outside end of the annular space was reduced to from 1-16 to $\frac{1}{8}$ -inch so as to prevent the asphalt squeezing out with the pressure of the water. After the lines had been in use for a time it was observed that the asphalt was being forced out, and once the water got through the asphalt would be cut away in no time. After a good deal of experimenting the best solution of the trouble was found to be to run a fillet of cement mortar around the end of the sleeve, practically making it a rigid joint, but weaker than the adjoining pipe, so that it would "give" first if expansion or contraction required movement at the expansion joint. As a matter of fact the writer never detected any movement at any of the expansion joints, either before or after they were cemented fast; and, in his opinion, expansion joints in a buried cement pipe line are of no use whatever.

The co-efficient of friction between even very smooth concrete pipe and earth is high, and when one considers the weight of the pipe, the contained water and the varying weight of backfill on the pipe, by any reasonable assumptions one may make, the amount of longitudinal reinforcement that would cause pipe to "creep" between expansion joints, even if only 100 feet apart, would be enormous. While it might be possible to build such pipe it would be quite another matter to find a customer who would be willing to pay for it.

Even in the interior of British Columbia, which has rather extreme ranges of temperature, the variation in the shell of pipe buried from 18 in. to 2-ft. below the surface is not likely to be more than 10 deg. to 12 deg., or say a variation in length of 0.055 ft. in 1,000 feet. With a modulus of elasticity of 2,000,000 in concrete, a 10 deg. variation would equal a stress of $9\frac{1}{4}$ lbs. per sq. in., either to stretch or compress the concrete sufficiently to compensate for change in temperature, but as concrete cannot be made perfectly homogeneous the strain would probably accumulate at weaker points and start cracks, circumferential cracks if in tension and longitudinal or diagonal cracks if in compression. Therefore it seems wise to provide longitudinal steel to distribute these strains as equally as possible. At 9,250 lbs. stress in the steel, 0.1 per cent. of steel would be required, and to the above stress in steel add that due to stretching or compressing the steel itself, which would be $30,000 \times 0.000055 \times 10 = 1650$ lbs., or a total unit stress of 10,900 lbs.; or say that for each degree variation in temperature 0.01 per cent. of steel is required. This is the writer's theory of longitudinal reinforcement

and he does not remember of having seen such analysis offered before.

Additional reinforcement may be required to take outward thrust on sharp curves, when the pressure would have to be considered.

"Swelling" in Concrete Pipes

A much more serious matter than changes of length due to temperature is the expansion in length that takes place when a newly laid, dry concrete pipe is filled with water and the expansion due to saturation takes place. The amount of this expansion is in-



Fig. 12.—Pipe line construction.

determinate as the degree of "dryness" of the pipe as laid may be anything from perfectly dry to perfectly wet, depending on the weather and the time that the pipe has laid in the sun and wind along the ditch. If a line of plain pipes is laid in a dry condition a dangerous compressive strain may be brought on them when they become saturated. A rupture from this cause will show about the same characteristics as a rupture from internal pressure, where there is any pressure at all internally. Where there is no internal pressure (as in a gravity flow line) the end compression will manifest itself by splitting the pipe lengthwise, or nearly so, in one or more places, generally two, and the two parts of the pipe will spring apart in bow-shaped segments, thereby shortening and giving relief to the strain. A crack so started will continue to run, just as a crack will run in plate glass, and unless discovered a lot of pipe may be lost. The failure of unreinforced pipe from this cause is very similar to the failure of un-hooped concrete columns. Like the columns, the remedy is to use hoops in the pipe; in other words, plain pipe has no place in important installations.

A very little steel seems to be sufficient, but we have no exact figures as to how little. The lightest reinforcement used on the work described herein was 1 hoop, $\frac{1}{8} \times \frac{3}{8}$ in. per foot in 12-in. pipe. Out of some thousand pieces of reinforced pipe laid none ever developed any crack or flaw that could be detected.

In the plain pipe there were eight ruptures that were believed to be the result of end compression and about the same number that were attributed to internal pressure only but may have been the result of compression, as the breaks did not occur where the head was particularly high. It was also found advisable to relay about 400 feet of plain 14-in. pipe working under a head of 24 to 28 feet with the same size of pipe reinforced with one $\frac{1}{8} \times \frac{1}{2}$ hoop per foot. There was a good deal of surging and air hammer in this section that caused a number of blow-outs and

warned us that there was not sufficient margin of safety.

The writer is of the opinion that if the money usually devoted to expansion joints and excess longitudinal steel in reinforced pipe were devoted to lightly hooping all the otherwise plain pipe, a much better balanced construction would result without appreciably increasing the cost of the installation.

It may be said of the "swelling" that once the pipe becomes saturated the pores begin to close and the pipe to dry up (on the outside at least) and very likely there is a gradual decrease from the maximum compression; in any even the writer's experience has been that no further compression ruptures occur after the line has been in use for a month or so, and even if emptied for a long time there will be very little swelling when again filled (referring of course to pipes below ground).

Testing and Permeability

When first filling the system the water was allowed to enter slowly so that the swelling might take place in advance of much pressure. The pipes were afterwards emptied and filled a number of times and no further precautions were taken, the water being admitted as rapidly as the supply permitted, to save time. As stated elsewhere there were no failures or faults developed in reinforced pipe, but there was some trouble with plain pipes, as noted. The test consisted in running the pipes at full capacity under as near working conditions as possible.

The opinion is prevalent that dry-rammed pipes are more permeable than pipes cast of wet mixtures, but our experience is to the contrary with machine-rammed pipe. The dry-rammed pipe is not quite as strong as the other, however. If the pipes become



Fig. 13.—Completed pipe line before back-filling trench—Standpipe in background.

thoroughly dried out before the water is admitted they will be quite permeable at first, but gradually take up and in from a few hours to a day or two the leakage through the pipe will stop. The percolation through the cement mortar joints will continue much longer, however,—perhaps for a month or more,—but these, too, will eventually dry off. Coating the pipe inside with a brush coat of cement grout soon after they are moulded will greatly reduce the amount of percolation at first, but the final result seems to be the same, whether they are coated or not.

After the above lateral No. 5 had been filled for a

few weeks it was very hard to tell, in most places, from an outside view of the pipes whether the water was in them or not, and this under heads up to 140 ft.

Thickness of shell does not seem important as long as the steel is properly protected and the pipe is strong enough to carry backfill. Some pipe was made without the addition of hydrated lime and this was no more permeable than that with lime. The writer sees no advantage in using lime or other waterproofing and thinks the money thereby saved would be better spent for additional care and time spent in moulding and curing.

Capacity of Pipes

The distribution system was planned for a delivery of 0.06 sec. ft. for 5 periods of four days each during the irrigation season, which gives an aggregate delivery of 2.45 acre feet per acre per season.

The discharge of pipes was figured by Kutter's formula, using $n = .013$. For pipes large enough that the joints may be trowelled inside, this friction co-efficient is too high, and we think .011 to .012 would give truer results if air is kept out. For small pipes, however, the stated factor is none too high. It does not pay to make less than 2-in. variations in diameter and it seldom happens that the calculated diameter just falls on a standard size of pipe, so that great refinement in calculating small diameters does not seem necessary. In fact it is not worth while to figure capacities at all unless comprehensive and sufficient measures are taken to exclude air from the pipes, as comparatively little air may reduce the capacity of a pipe 25 to 50 per cent. or more if the velocity is high, and to properly exclude the air seems to require more experience and higher engineering skill than any other single feature of a pipe installation. Irrigation distributing lines are quite different from power or waterworks pipe lines, inasmuch as the former usually have but one place where air will be admitted at the intake, while irrigation lines must have



Fig. 14.—Distribution box used on pipe line.

comparatively large openings at rather short intervals, which will discharge water or take in air impartially unless carefully designed. The writer has seen some that would perform both functions simultaneously. No matter how carefully planned, some air will gain admittance and will cause surges that will raise the static head 10 or 15 feet or more and should be allowed for in figuring strength of pipe.

Distribution Boxes

Delivery of water from the mains is made through concrete distribution boxes, one type of which is shown in Fig. 14. These boxes have an interior par-

tion, with an opening near the bottom, closed by a slide gate. When this gate is open the water flows directly through and re-enters the main below the box.

When the gate is closed the water rises in the box and overflows a weir in the top of the partition. In another partition plate is an orifice 4-in. high by 12 to 24 in. long, with sliding shutters by means of which the length of orifice may be reduced.

The centre of this orifice is exactly 4 in. below the lip of the overflow weir in main partition. The Water

Concrete in
Irrigation Work
in the
Okanagan Valley.

Fig. 15.
Standpipe for
controlling
hydraulic
grade.



Bailiff is provided with a table showing the discharge through the orifice for each inch (or fraction thereof) of length, and the sliding shutters are set to deliver the desired quantity, then the bottom slide gate is closed until the water rises and just nicely overflows the waste weir.

This maintains the standard depth of 4 in. to centre of orifice and makes some allowance for fluctuations in the main. The water passing over the waste weir falls to the bottom of the box and re-enters the main below the box. The water passing the orifice falls into a trough and is led through the side of the box above the ground level. The arrangement is such that the position of the shutters or slide gate can not be altered from the outside of the box. The entire construction, except iron slide gate and wooden door over man-way in cover, is concrete. The door is secured with a padlock.

Standpipes were erected in several places to control the hydraulic grade line where it happened that the summit on the main pipe was lower than the ground to be irrigated. One of these is shown in Fig. 15. It is built up of 30-in. reinforced pipe, surrounding a 20-in. interior riser through which the water rises and returns in the annular space between the two pipes. A by-pass is provided so that the water may be sent directly through if desired. These standpipes acted to a certain extent as surge tanks.

In conclusion, in justice to the other irrigation companies in the Kelowna district, it must be said that the standard set by the South Kelowna Company is approached by several others. Of the four larger systems in the district the Central Okanagan Company have all or practically all their ditches lined with concrete, and steel and wood pipe distribution, and the Belgo-Canadian Company and Kelowna Land and Orchard Company have partly lined canals and are extending the lining yearly, and are using concrete pipe extensively. No first-class company now considers the use of wood flumes or earth ditches, and the standard of construction is constantly rising.

Application of Brick in Engineering Construction*

By E. E. R. Tratman†

THE use of brick in engineering work is extensive and varied. In recent years its use has become considerably restricted in some lines of construction, while some new lines have become important.

Brick for Sewer Construction

The sewer systems of cities afford one of the largest fields for the use of brick. Much of the work is of an ordinary character, but there are many cases in which size, form, special design, methods of construction, or difficulties encountered, make the work of interest to the engineer. At Detroit, most of the sewers are of brick. The largest brick sewer planned and built during 1913 was the Morrell St. sewer, about five miles long, from 8 to 9 ft. diameter, and costing \$685,000. A similar trunk sewer now under construction is the Mt. Elliott Avenue sewer, a considerable portion of which is 9 ft. diameter, built in tunnel.

At Cincinnati there are about 80 miles of brick trunk sewers. Brick is used for all sewers over 2 ft. diameter, and the largest brick sewer is about 20 ft. diameter. The larger sizes (and the smaller ones where necessary) are backed up with haunch walls of rubble masonry or concrete. Vitrified-brick lining is used in the inverts of concrete sewers (up to the springing line) but only where the velocity of flow is excessive; that is, over 8 ft. per sec. In some cities, however, all concrete sewers are lined with brick (at least in the invert), while others do not use brick in any of their concrete sewers.

At St. Louis, brick is used for all sewers over 27 in. diameter and up to 9 ft. diameter, and is used for still larger sizes in special cases. During 1913 there was under construction the Rocky Branch joint district sewer, 10 and 14 ft. diameter, brick being used because the congested condition of the streets made the establishment of a concrete plant a difficult matter. There was also the Glaise Creek joint district sewer, a trunk sewer of 10 ft. down to 8 ft. diameter, brick being used entirely because the amount over 9 ft. diameter was too small to warrant installing a concrete plant. Vitrified-brick lining is used in the invert of concrete sewers.

At Philadelphia, brick is used in egg-shaped sewers 2 ft. 3 in. by 1 ft. 6 in. to 4 ft. 6 in. by 3 ft. and in circular sewers from 2 ft. to 20 ft. diameter. Concrete is used only for sewers up to 5 ft. diameter except in special cases, and has brick lining in the invert only.

In Chicago there are about 1,958 miles of sewers, of which all but $14\frac{1}{2}$ miles are of brick, with a diameter of 3 ft. to $10\frac{1}{2}$ ft. The largest concrete sewer is of elliptical section 14 ft. high and 12 ft. wide. No brick lining is used in any of the concrete sewers in Chicago or Kansas City.

At Cleveland, all but about 6 per cent. of the large sewers are of brick, the smallest size being egg-shaped in section, 24 in. wide and 27 in. high, and the largest being 16 ft. diameter. Concrete is used to a considerable extent for the foundations of sewers, and in sev-

eral cases there has been used a combination of brick lining for the entire inner ring, backed with concrete.

At Minneapolis, brick is used only for the manholes and catchbasins. At Kansas City, no brick sewers have been built for three years. For sewers over 30 in. diameter, bids are asked on brick, reinforced monolithic concrete, and reinforced-concrete pipe. The awards are made to the lowest price material, which is generally monolithic concrete, but in some cases concrete pipe. The concrete sewers are not lined with brick. A special development is the use of hollow segmental blocks, and, owing to their size and light weight, the work can be done much more rapidly than with brick. These blocks have been used in sewers from 27 in. to 6 ft. diameter, and are made for sizes up to 9 ft. diameter.

Brick Tunnel Lining

At Chicago, brick has been used in certain parts of the Chicago Avenue and Wilson Avenue tunnels of the water-works system; in all about $\frac{1}{2}$ mile of tunnel, 8 ft. diameter. The water-intake tunnels at Cleveland have a brick lining, and brick is to be used also in the new intake tunnel at Milwaukee. At Cleveland, a long intercepting sewer has been built parallel to the short line, and nearly five miles of this are in tunnel with a four-ring brick lining, having an interior diameter of $13\frac{1}{2}$ ft. and $12\frac{1}{4}$ ft. This was driven in stiff clay soil, by means of a steel shield. The bricks were laid in Portland cement mortar, and though the jacks pressed against the end of the completed lining, the only damage done was at the points of application of the jacks, and this small amount of masonry was repaired each day as the shield advanced.

The lining of railway tunnels was at one time a field for brick, but this is now much less extensive. An example of modern work is the double-track Elm tunnel on the Frankfort & Berlin Railway in Germany. This is $2\frac{1}{4}$ miles long, and was built under considerable difficulties, owing to the pressure or "squeeze" of the ground. The celebrated Thames tunnel was built of brick, as were the large double-track arched tunnels of the original underground railways at London. These were near the surface, but the present "tube" lines are single-track deep-level tubes with cast-iron lining. With the advent of the modern subway and underground railway there has been opened a rather large field for the architectural or decorative use of brick in the facing of the tunnel lining at the stations, and, though this is mainly for glazed and ornamental brick, it indicates how new fields open, although old fields for the use of brick may become closed or restricted.

Chimneys

Most important brick chimneys now built of special radial hollow brick. The monster brick chimney for the Boston & Montana Copper Company, at Great Falls, Mont., is 506 ft. high and 50 ft. diameter at the top, the proportions being very unusual. It is built on the Custodis system, and is said to be both the tallest and largest chimney in the world. Next to it comes a Heinecke brick chimney 460 ft. high, but with a diameter of only 8 ft. at the top. This chimney carries the

* Abstract of a paper presented at the annual convention of the National Brick Manufacturers' Association, New Orleans, Mar. 2-7, 1914.
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and gases from smelters and is reported to show no deterioration after 20 years' service.

Another exceptional brick chimney, which is large in diameter as well as in height, is that of the St. Joseph Lead Company, at Herculaneum, Mo. This is 350 ft. high and 20 ft. diameter at the top. It has an octagonal base 40 ft. high and a circular shaft 310 ft. high. The base contains two openings and is built of vitrified paving brick, laid in English bond. The shaft is built of the Heine perforated interlocking radial brick, and the walls are laid up with alternate header and stretcher courses. The chimney is reinforced by steel bands 4 x ½ in., embedded in the brickwork, and spaced about 20 ft. apart for the entire height. Only the lower part of the interior is protected by a lining (40 ft. high), owing to the relatively low temperatures of the entering gases. Both the paving brick and the radial brick were hard-burned shale brick, having a compressive strength of over 5,000 lb. per sq. in. and with a very low absorption. They were tested for their acid-resisting qualities by immersion in 25 per cent. sulphuric-acid solution for 48 hr. and afterward by boiling this solution continuously for 30 min. without removing the sample from the solution. No effects of the acid on the brick were noted.

The chimney was built to carry off the products of combustion and the fumes of a lead-smelter plant. The gases have a temperature of about 200 deg. F. and contain a high percentage of sulphur, making it necessary to build the chimney of acid-proof materials. The bricks are laid in lime-cement mortar, on account of its strength, but as this mortar is decomposed in time under the influence of the acid in the gases, all the mortar joints liable to be attacked by the contact of the gases were made acid-proof. The interior joints for the entire height of the chimney and the exterior joints for 100 ft. down from the top were raked out to a depth of 1½ in. and pointed up with a mortar made of raw benezet. The entire lining was laid with this mortar. The material is a very high grade of fire-clay and is acid-proof; it contains about 36 per cent. alumina and 49 per cent. silica, with only a trace of lime, magnesia and iron oxide. The top of the chimney is covered with a heavy lead cap, extending 12 in. on the inside and outside, and for 100 ft. from the top the iron ladder rungs are covered with ⅛-in. of lead.

Quite recently a brick chimney has been built at a blast-furnace plant, serving the hot-blast stoves, which is said to be the first used for this particular purpose. At industrial plants there has been a tendency to use steel chimneys serving one or two boilers each, due to a certain prejudice against a single large central brick stack, but there is a much greater loss of heat through the steel stack, due to radiation and convection, unless there is the additional expense of a brick lining.

Brick for Paving

The use of brick for paving is a matter of great engineering importance, and in the past 15 or 20 years the manufacture of paving brick has developed into a special industry. Engineering, experimental and research or laboratory work, has assisted largely in this development, in various ways: 1, the investigation of clays and their properties; 2, the manufacture of the brick, so as to secure a tough, hard and uniform product; 3, the testing of the finished product; and 4, the proper methods of constructing the pavement. For many years, brick paving was confined mainly to the streets of towns and cities but it is now being applied extensively to the paving of country highways.

At one time brick was extensively used for bridges and large arches, but this use has become practically obsolete in this country and is on the decline in other countries. However, in some arch bridges of concrete construction brick is used as a facing, in order to produce an effective appearance and to form a durable surface finish. This has been done more extensively abroad, but one example in this country is the Sixth Avenue bridge in Des Moines, Iowa, which has a series of arches, with red-brick facing on the arches and piers.

Another use of brick which is more common abroad than in this country is the facing of the walls of docks and piers. Concrete forms the mass of the wall, but this material is often liable to disintegration, particularly at the water line. It is also difficult to repair when worn or when the surface is broken by heavy blows or chafing. The brick used for this facing, in foreign work, are usually of a special character, much larger than ordinary brick, extremely hard, and frequently dark blue in color. At points on the Nova Scotia coast walls have been faced with vitrified brick.

Present-Day Practice in Concrete Road Construction

GREAT care is requisite in order to obtain good results in concrete pavements. In discussing the value of such pavements, there is, of course, some question as to the kind and amount of traffic they will stand. In Massachusetts, in 1906, a concrete surface was laid on a section of State highway in the town of Spencer, and stood the traffic remarkably well. The principal objection was that it was rather hard for the feet of the country-bred horses, which, if allowed to select the traveled way, turn out on the earth shoulders. A bituminous surface remedied this condition, and at present the road is giving excellent service. The section mentioned was put down by the grouting method, known as the Hassam process. On investigation it was found that the grout had penetrated, not only 6 in. of broken stone, but an additional 2 in. of gravel sub-surface. Very little trouble was experienced from disintegration of the concrete surface; it was confined principally to the area adjacent to the expansion joints.

Since that time some roads have been built by mixing the concrete before placing. Care had to be taken to have the batch properly tempered, particularly in building on a grade. If too wet, the mortar had a tendency to creep and form waves on the surface, and, of course, a dry mixture was not readily flushed, hence it was difficult to get a good smooth surface. The concrete was placed in a single layer, and as near a mosaic surface as possible was decided, in order to permit the bituminous material to bond properly. To obtain that result, various methods were tried. After placing the concrete, dry stone was spread over it, and tamped lightly. This worked well, but required considerable skill on the part of the men who were spreading the broken stone. The experiment of allowing the concrete to set twenty-four hours, and then brushing it off with a steel broom, gave, perhaps, the most satisfactory results.

Mixture Too Lean

There is a tendency to use too lean a mixture for concrete road surfaces. Many engineers have advocated a 1:3:6 mixture, but that is not rich enough,

for concrete exposed to the traction of wheels and blows from horses' hoofs must be very tough to resist abrasion. Added strength cannot be gained by reducing the percentage of stone aggregate, that is, assuming 2 parts of sand to be the correct quantity to be used with 1 part of cement. Such a mortar will fill the voids in 4 parts of stone, and no added strength is gained by reducing the stone aggregate to three parts. Too small a proportion of stone means a large percentage of mortar, thus giving a smooth surface, which would be slippery and not desirable.

The concrete pavement has the advantage of being not only a surface, but also a foundation. Though, of course, there may be conditions where some treatment of the sub-surface will be needed, with a uniform soil, in which the frost action is about the same in all parts, there is very little difficulty. If, however, the soil is varied, so that the frost will affect one portion of the road more than another, the concrete will crack. It is an unusual condition where such cracks are serious enough to disintegrate the concrete, and any ordinary cracking is not material. This is particularly true where concrete is coated with a bituminous material, as the cracks are then sealed over and give no trouble. With concrete, as with all other smooth paving, the surface is rather slippery, necessitating care in designing the maximum grades and the camber of the road.

A light bituminous top on a cement-concrete base solves many road problems. It is reported that there is much difficulty in making the bituminous material stick to the concrete. In Massachusetts success has been obtained by the following method: The concrete surface is swept as clean as possible, then sprinkled with water, and while still wet covered with Tarvia A, heated to 200 deg. Fahr. and applied at a pressure of not less than 70 lbs. per sq. in., and at the rate of one-quarter gallon per square yard of surface. This is then covered with clean stone screenings (not exceeding $\frac{1}{2}$ in. in diameter and from which the flour has been removed) spread at the rate of 0.015 tons per square yard of surface. This is again watered and while still wet a second $\frac{1}{4}$ -gal. coating of tar is applied in the same manner as before, but covered with clean, gravelly sand, using 0.015 cu. yd. per sq. yd. of surface.

I am aware that the application of tar on a wet surface is contrary to existing theories, but it has worked satisfactorily. This road, treated in August, 1910, has cost to date, \$15 for total repairs on more than 4,000 lin. ft. of 15-ft. surface and it has taken only 30 gal. of tar to replace such small places as have scaled off. I believe that the successful adhesion of the tar to the concrete is due to the wet surface of the latter and the high pressure used in spraying the tar on the road.

Recommendations for Concrete Road Building

Principles Advocated by the National Conference on Concrete Road Building

FUNDAMENTAL principles of concrete-road construction were adopted at the National Conference on Concrete-Road Building, held in Chicago last month. The salient features of the recommended practice are:

1. The aggregate should be clean and hard.
2. The sand should be coarse and well graded.
3. A rich mixture should be used.
4. The materials should be correctly proportioned.
5. The materials should be thoroughly mixed.
6. The inspection should be intelligent and thorough.
7. When in doubt, reinforce the pavement.
8. The subgrade should be of uniform density, thoroughly compacted and drenched with water immediately before placing concrete.
9. The concrete should be of a viscous, plastic consistency.
10. After placing, the concrete should be immediately covered and kept moist and not opened to traffic for four weeks.

Additional Suggestions

For all roadways less than 20 ft. in width is recommended a cross-section showing a slab thicker in the middle than on the edge, built upon a flat subgrade. The dished subgrade recommended in the report of the committee on contraction and expansion is not mentioned.

Minimum widths of 10 ft. for single-track and 18 ft. for double-track roads are approved. In the country a crown of 1/100 of the width is recommended; for city pavements the specified crown is 1/70.

The use of suitable reinforcing at the junction of shoulders and metal, as stiff gravel or stone chips, is urged.

Joints should be avoided, if possible. Reinforcing the slab is the alternative suggested. In fact, it is urged that all roads exceeding 20 ft. in width be reinforced with wire fabric whose co-ordinate cross-sectional areas are 0.038 sq. in. and 0.049 sq. in. per foot, the greater section to be applied transversely. The type of filler recommended, if joints are necessary, is that made of two 3 x 3-16-in. strips of metal separated by about $\frac{1}{4}$ in. of prepared felt.

Adding materials or water to mortar or concrete that has partly hardened and carrying on work during freezing weather are practices strongly condemned. If the temperature should drop below 35 deg. Fahr., the water and aggregates should be heated and the work protected from freezing for at least ten days. Concrete should not be deposited upon subgrade that is frozen.

Cement is handled in bulk for the construction of the new plant of the Baldwin Locomotive Works at East Chicago, Ind. The foundations involved more than 10,000 cubic yards of concrete, and cement in bulk was brought to the contractors' attention as a means of making a considerable saving. Cars are spotted alongside the mixer bin and both sand and gravel are delivered directly to the bins by a clamshell bucket. Bulk cement, however, required a system of elevator buckets on an endless chain and a modified grain shovel, operated by power and guided by a laborer, is placed in the car and manipulated in a manner similar to that of a grain-hauling shovel or a scraper.

Relative Economy of Constructing Bituminous Concrete Pavements and Bituminous Pavements by Penetration Methods*

By Geo. C. Warren†

KEEPING constantly in mind a broad view of the term "economy," the writer proposes to discuss only: (a) true "Bituminous Concrete" and (b) "Bituminous Macadam" defined by the American Society of Municipal Improvements, as follows:

"Bituminous Pavement Definitions"

"**Bituminous Concrete** is a pavement consisting of a combination of broken stone and sand, or fine mineral matter, cemented together with a bituminous cement, and which has all its ingredients mechanically mixed before being laid. To be termed a bituminous concrete it must partake of the well-known characteristics of concrete, that is, there must be stone enough in its composition to form an important part thereof and add to its strength and durability; also there must be enough of the mortar constituent, that is, the sand and bituminous cement, to properly support and bond together the largest particles. It is nor-

base, as in their nature they must be knit together in one structure. Practically all the horizontal stability as well as vertical support is from the macadam base."

As it is manifestly impossible to express a true comparison of the economy of these two types of construction in dollars and cents, the writer will endeavour to show the relative satisfaction which has been given the public by several instances where both types have been in use on the same street for several years.

In a paper prepared by the writer for the International Road Congress held in Brussels in July, 1910, on the subject of "Bituminous Roads—Mixed and Poured" he referred to a then recently constructed "Bituminous Macadam Penetration Method" road then one year old and constructed with most careful consideration of the details and most approved methods of construction on Huntington Avenue, Boston, one



Road laid with asphalt cement by the penetration method—after four years' use. Note general wavy condition and ravelled section.



Bituminous concrete pavement laid in 1905. In excellent condition after eight years' use.

mally a one-layer pavement, all parts of it having equal stability, due both to the structure of stone and the bond of the bituminous cement, and depending on the base for vertical support only. It may or may not be finished with a skim coat and top dressing of sand or stone chips. It is adapted to be laid on either a concrete or macadam base which may or may not have a light coat of bitumen to increase the adhesion."

"In the paving mixture, gravel may wholly or in part be substituted for crushed stone, and fine crushed stone for sand. Mineral dust also may be added to increase the density and stability of the mixture."

"**Bituminous Macadam** is a pavement consisting principally of crushed stone, retains its integrity of structure mainly by the mutual support of the various particles of stone, aided by the slight bonding value of the fine mineral matter in its composition, and protected from surface disturbances by an upper bonding layer of bituminous material. It is a one-layer pavement and there is no definite distinction to be made between the wearing surface and the

section using bituminous cement prepared from coal tar and the other from asphalt.

A series of eighteen photographs accompanied that paper, showing, that notwithstanding the unusual care practised in the construction, the unequal distribution of the bitumen was such that the surface of the road was badly marked, rutted, and shoved, in many places having a surplus of bituminous material, and in many other places pitted and ravelled where insufficient bitumen was distributed, or where it had penetrated insufficiently into the voids between the particles of stone.

Now, after four years' use and very considerable repairs each year the bituminous material on the section laid with bituminous cement prepared from coal tar has practically all disappeared, and the macadam, which is also badly worn, is carrying the traffic. In small portions of the surface, where a surplus of bituminous material was used, it is still in evidence.

The section in which asphalt cement was used, is, after four years' use, in better condition than the coal tar cement section referred to above, because, in the asphalt section the asphalt for the most part is still in evidence, but the road surface is in a most deplorably

* Extract of paper presented before Section D of the American Association for the Advancement of Science.

† President Warren Brothers Company, Boston, Mass.

unsatisfactory condition, as may be seen in Fig. 1.

On the same side of Huntington Avenue, but two miles nearer the centre of the city, and consequently carrying more than double the volume of traffic than the "Penetration Method" construction above referred to, is a "Bituminous Concrete Mixed Method" pavement laid in 1905, which has stood the traffic of eight years and is illustrated in Fig. 2.

The relative economy of these two stretches of pavement is about as follows:

1st. Length of time street was closed to traffic during initial construction, about equal for the two types.

2nd. General appearance of street surface at time construction was completed, about equal.

3rd. General appearance during the first warm weather in the spring following construction: Bituminous concrete presented uniform, hard, gritty surface, affording easy traction, and good footing for horses.

Penetration method, where insufficient amount of bitumen had been used, was already ravelling in spots, but where excess of bitumen had been used, surface was badly shoved in spots, and bleeding to such an extent that the area which had been laid with asphalt cement was given a coat of crushed screenings, which soon ground up and made the street exceedingly dusty for some weeks, and also made traction so heavy during warm weather, that horses approaching this stretch at a trot would break into a walk before traversing one-half its length.

4th. Interruption to traffic while making repairs: Bituminous concrete, has stood for eight years without any such interruption.

Penetration method, has during the four years of its life, been repaired in spots many times, with traffic naturally impeded, even though not entirely blocked by the repair gang.

5th. Initial cost of the stretch laid by the penetration method is not known by the writer, but was probably about two-thirds that of the bituminous concrete.

Summarizing the above shows that these two types of construction have given the city service as follows.

Bituminous concrete: a wearing surface perfectly satisfactory for all classes of traffic for eight years. The volume of traffic being moderately heavy at times of construction, and steadily increasing since that time.

Penetration method: gave satisfactory wearing surface during the few winter months immediately succeeding its construction, but has never been satisfactory since that time.

This construction was cheap in first cost, but its present condition well illustrates the fact which should be axiomatic, but is not generally so regarded, that first cost is but one and that a small factor in the question of economy.

True "economy" in road or pavement construction cannot be measured by dollars and cents of cost, however frequently the effort may be made to so measure it. Consequently in considering the subject the writer is not making any effort to discuss "economy" from that point of view. The real measures of economy are, general suitability for the purpose intended, durability, utility, wear and tear on vehicles, sanitation, cleanliness, sightliness, and last and not least of all, first cost. These are matters which must or should receive careful consideration in each particular case.

Doubtless there are some places where the traffic is so exceedingly light that the penetration method will produce a surface which will answer all practical purposes, and in such cases the less cost of this type would naturally make it the more economical in the broad sense in which the writer has endeavoured to view the

subject. However it is the writer's firm belief that such cases are exceedingly rare, and that in judging any one particular case, it is exceedingly dangerous policy to assume that this type of construction will give any better satisfaction to the general public than the cases cited in this paper; and when forming such a judgment, it must be remembered that the traffic on all streets and roads is increasing by leaps and bounds, and at far greater rate than it increased in former years, therefore the tendency is always to underestimate the amount of traffic a street or road will be called upon to resist.

In conclusion, we must not be unmindful of the fact that in the construction of any type of roadway surface, full consideration must be given to careful, scientific, accurate details of construction and to the further fact that "the best is none too good" applies with special force to road construction.

Portable vs. Stationary Asphalt Plants Experience with One Plant of each Kind in Winnipeg—Reasons Why the Writer Prefers Portable Plant

By J.W. Astley, C.E.*

THE writer, as the city's engineer of construction, is required to bid against all classes of contractors and, consequently, sees things from a contractor's point of view, viz., what are the quickest, cheapest, and most reliable methods? When he was appointed engineer of construction of Winnipeg in 1907, he had to adapt himself to circumstances as he found them. The city at that time had a stationary plant capable of handling 2,000 square yards per day of finished sheet asphalt pavement, 1½-inch binder and 2-inch surface. At the present time, by the use of labor-saving appliances, the same plant can handle 3,000 square yards of the same class of pavement per day, with 30 less men per day at the plant.

This plant was so situated, however, that the only materials that could be delivered to it by rail were asphalt, flux and sand. All other raw material had to be teamed 1½ miles from a supply yard. The purchase of another, a one-car Cummer plant, was recommended in 1910 and has been in use ever since. In this plant the material is dumped from an overhead railway right above the plant, and the saving in hauling and handling material amounts to a trifle over 3 cents per square yard on binder, this being shown by the actual records for four years; and a saving of 4 cents per square yard is made when handling asphaltic concrete, which is laid 2 inches thick on a concrete base. The old plant is used on surface, also for streets in the immediate vicinity, and a saving of from one cent to 2 cents per square yard is made. This saving on the surface is effected by a small reduction in the amount of fuel for melting and in labor.

The question of cost of long haul in delivering material to the street is not so important here as in many cities, because we use a truck carrying 5 cubic yards of asphalt and hauling a trailer with another 5 cubic yards. This truck, which was made by our own mechanics, makes 12 miles per hour empty and 8 miles loaded. Three gasoline tractors also are used, each of which handles a train of five 2½-cubic yard asphalt wagons. These make 3½ miles per hour loaded and 6 miles empty. In another respect our plants are different from the majority, being operated

* Engineer of Construction for the city of Winnipeg.

by electricity, the only fuel used being for melting, heating sand, stone, etc., the melting all being done by direct heat with mechanical agitators.

In operating our plant no uncoupling of the strings of wagons is necessary, as they are drawn under the hopper by a cable operated by the regular engineer. The asphalt is hoisted and swung into the melting kettle by a small swinging derrick operated by the same man, and the hopper is handled by the same means.

The one-car plant which we have in use we always count on, from actual practice, for 3,000 square yards of 1½-inch binder a day and from 1,800 to 2,000 square yards of 2-inch surface.

The stationary plant was the first stationary municipal plant in Canada and, it is believed, the first on this continent, and, consequently, was not built as we would do it at the present time; steel and concrete would be used in place of wood. The maintenance costs are, therefore, greater than they would otherwise be, so a comparison in this respect would not be fair. The yearly maintenance cost for the one-car plant is very small, as, outside of a few new sprocket chains, small repairs to fire brick and to a dust collector, nothing has got out of order, and \$300 per year so far has covered all our expenses for repairs.

The question of our future has already been taken in hand, by the purchase and outfitting of supply yards with elevated railway tracks. After possibly another year, the one-car plant will be moved to one of these yards and do all the work within a reasonable haul, and then move to the next yard direct. The stationary plant will then be done away with, and when the amount of work warrants it the purchase of a second one-car Cummer plant will certainly be recommended by the writer.

From my point of view I would prefer to purchase a one-car plant for use in any town of, say, 60,000 people in place of building a stationary plant; for even if it is left stationary for some years it will be found to occupy less room, cost less to keep in repair, and will do as much work as a stationary plant costing the same money. For larger cities that have enough work for two or more plants I would again recommend one-car plants, and more especially if the city has numerous railway lines, making it possible to move the plants near to the work in any district.

The main question from a contractor's point of view (and it should be the city's) is to get cheap delivery and handling of material at the machine. The question of delivery to the street and laying the asphalt can be easily checked up daily and a general hustle kept up, but the other end of the work is where expenses creep in and are very hard to detect.

In actual practice it will be found that more labor-saving appliances can be used on a portable plant than on a stationary plant, and, every man employed being in full view of the foreman, better results can be obtained.

The safety of St. Paul's Cathedral, London, Eng., which has caused a great architectural controversy for several years, continues to exercise the minds of engineers. It has produced the suggestion that the foundations of the cathedral should be immersed in a moist earth tank. It is proposed to utilize the blue London clay subsoil as a floor on which to build a reinforced concrete wall below the street level of the cathedral and then water the enclosed earth by vertical perforated pipes.

Examples of Poor Design and Improper Operation of Small Water Purification Plants

THE fact that small water purification plants are frequently abused in their operation is, as we have before stated, well known to engineers.

It is with a view, therefore, of supplying engineers with additional data on this point, for use as illustrative examples in their efforts to impress upon city officials the importance of competent operation of such plants, that we are here publishing an abstract of a paper recently presented by H. P. Letton, Sanitary Engineer of the United States Public Health Service, before the New England Water Works Association.

It very frequently happens that when a small water purification plant is installed in connection with a water works system which has been in operation for some time, perhaps for several years, that the man who has had charge of the pumping station takes on the operation of the purification plant as an additional duty. It is very uncommon, indeed, for men of this type to understand the process of water purification, even in its fundamentals. In connection with the discharge of his duties Mr. Letton has had an unusually good opportunity to observe the more common faults in the design and operation of the type of plants here under consideration and he mentions the following examples.

Examples of Poor Design

The worst example cited related to a plant of 1,000,000 gals. daily capacity. The water supply, obtained from an artificial lake, was highly colored, due to passing through cedar swamps. The water flowed from the lake to the coagulation basins by gravity. In this basin, which was merely a wooden tank, a period of less than 20 minutes ordinarily was employed for coagulation and sedimentation purposes. This period was still shorter in times of high water consumption. Moreover, the coagulation basin was set at such a high level that in times of low water in the lake it was necessary to by-pass raw water around the basin in order to maintain the necessary supply. The filter plant consisted of four rapid sand, circular, wooden tank filters, operated by gravity and fed by a gravity flow from the coagulation basin. The filters were not equipped with either loss of head gages or rate controllers. The beds were not agitated during washing because the rakes provided for that purpose were fitted up for water motor drive and the necessary water pressure for actuating this motor was lacking. After leaving the filter the water passed to a suction well giving less than 30 minutes' storage. A small solution pump, for pumping a solution of sulphate of alumina into the raw water just above the coagulation basin, was supposed to be driven from the main shaft which drove the pumps of the distribution systems. It was learned, however, that this solution pump was normally out of service and that for the greater part of the time no coagulating chemical was injected into the raw water. Upon making an analysis of the raw water it was discovered that it was slightly acid, probably due to humic acid taken up by the water in passing through the cedar swamp previously mentioned. Under these circumstances the addition of the sulphate of alumina would have been useless. Analyses were made of both the raw and filtered water and the improvement shown by the filtered over the raw water

was but slight. The color of the filtered water was at times at 200 p.p.m.

Mr. Letton investigated two other plants in which acid waters were being treated with sulphate of alumina only. Among the small plants inspected rate controllers and loss of head gages were seldom found, and the methods employed in controlling the chemical feed were in most cases very crude. Only a few calibrated orifice boxes were found in service. Two gravity rapid sand filters, which treated waters of high-organic content and frequently turbid, were not operated in conjunction with coagulation basins. This led to too frequent washing of the filter sand and the bacterial efficiency of the filters was correspondingly lessened, and operation costs were increased.

One large pressure filter was found treating a turbid water without sufficient time for coagulation. The effluent from this filter was frequently turbid and sometimes contained aluminum hydrate. Another plant, a slow sand plant, had less than 1 ft. of filtering sand and the capacity of the accompanying clear water well was about a half hour's supply. The rate of filtration consequently fluctuated exactly as the demand and almost no advantage resulted from filtration.

At one rapid plant raw water was used for filter washing because the clear water basin was so small. Still another plant was not designed so that it could filter to waste. Accordingly when it was necessary to gain access to the strainer system the dirty water in the bed was discharged into the clear well.

Examples of Faulty Operation

Although good results in rapid sand plants are so largely dependent upon the proper use of the coagulant, Mr. Letton observed great ignorance on this point on the part of operators of small plants. At several plants the operator measured alum by the pailful per day, without knowing the weight used or the proportion to the water treated. A few operators stated that they increased the amount of alum somewhat when the raw water was turbid, but the increase was governed only by the operator's imperfect sense of proportion and not by precise measurement of any kind. In only a few plants inspected was it found the practice to regulate the dosing by the results of making alkalinity and turbidity tests. Only a few of the operators could accurately make the alkalinity tests. Only two plants of less than 20,000,000 gals. daily capacity maintained laboratories, and even in these the chemical and bacteriological tests were made under the direction of non-resident specialists, the operators who made the tests being unable to interpret them or to use them as a guide in operating the plant.

At one plant the operator was too lazy to wash the filters sufficiently often and they clogged badly. This decrease in filtered output was made up by by-passing raw water around the plant. At another plant the beds were washed too often and the bacterial efficiency was low and the cost of operation was high. At this plant over 10 per cent. of the water filtered was being used for wash water.—Engineering and Contracting.

The Design of Sewage Treatment Works in Saskatchewan

SUGGESTIONS as to the design of sewage treatment works for municipalities in the province of Saskatchewan are contained in a government bulletin, an advance copy of which has reached us. It is pointed out that these suggestions are intended only as a guide and not as a limitation upon originality in design where modifications may be necessary to meet the requirements of the local conditions. The suggestions follow:

1.—Screening.

(a) That where sewage is to be pumped, provision be made for screening, cleaning the screens at regular intervals, and for removing and disposing of screenings.

(b) That where works are of a character producing a large quantity of screenings, mechanical means be provided for their removal.

2.—Grit Chambers.

(a) The function of grit chambers (or detritus tanks) being to arrest the heavier mineral particles carried in suspension, the construction of such tanks, is, generally speaking, unnecessary in this province, where the majority of sewage systems are designed on the "separate" principle.

(b) That in special cases where sand or other mineral particles cannot be kept out of the sewerage system, it is advisable to introduce grit chambers.

(c) That these be constructed in multiple compartments to take care of the varying volume of flow.

(d) That a lineal velocity of one foot per second be aimed at, calculated to retain the heavy mineral, but not the organic matters.

3.—Pumping.

(a) That where it is necessary to raise the sewage at the works, it is advisable that all machinery be in duplicate with alternative forms of power in case of failure.

(b) That appliances for raising sewage be specified with reference to efficiency in dealing with solids.

4.—Sedimentation.

(a) That there be at least two sedimentation tanks.

(b) That such tanks be so constructed that the precipitated solids are automatically and continuously removed from that portion of the tank in which precipitation takes place, and that a tank or chamber combined with, or separate from, the sedimentation tank, be provided, into which the precipitated solids may pass by gravitation immediately following treatment.

(c) That consequent upon the modern requirement of the continuous removal of sludge as above stated, all base slopes of sedimentation tanks be made as near to the perpendicular as is practicable, relative to general construction.

(d) That the tank capacity be equal to one-fifth of the dry weather flow in twenty-four hours, or equal to three hours' flow calculated upon the twenty-four hours' dry weather flow taking place in fifteen hours.

(e) That the cross sectional area of the tanks provide a velocity of flow of not more than .05 foot per second, while lower velocities are preferable. Flows may be either vertical or horizontal.

(f) That consideration be given to the design of the inlets and outlets with a view to ensuring uniformity of flow throughout the breadth of the tank, and the absence of stagnant sections; and that all channels and parts of the tanks apart from the sludge storage area, be so constructed that no solids are retained.

5.—Sludge Storage.

(a) That the overall depth of the sludge storage chamber from the surface of sewage in sedimentation tank be gen-

erally not less than fifteen feet. Greater depths may be adopted, producing a more concentrated form of sludge.

(b) That in deep tanks, wherever possible, provision be made for breaking up the sludge at the inlet to the sludge removal pipe.

(c) That the capacity of the sludge storage chamber be equal to at least four months' precipitation of sludge, containing 85 per cent. of water. Greater storage capacity is preferable as septic action is delayed in winter months. The cubic capacity of the sludge storage chamber shall be taken as only that space which is below the level of the deepest point of the sedimentation tank. In general, the average accumulation of sludge may be taken as three and a half cubic yards per million gallons of sewage on the above basis of dilution.

(d) That ample provision be made for the escape of gases from the surface of the sludge storage chamber.

(e) That pipes for the conveyance of sludge be of an internal diameter of not less than eight inches and that the inclination of such pipes, where the sludge is discharged by gravity, be at least 3 per cent. and preferably 5 per cent.

6. Biological Filtration.

(a) Where a dosing or siphon chamber is constructed to regulate the flow of the sewage over the surface of filter beds, that the capacity of such chamber does not exceed a ratio of two gallons of sewage to each square yard of filter surface. For instance, if the area of the filtering surface be two hundred square yards, the capacity of the dosing chamber should not exceed four hundred gallons, representing a dose of one-half inch depth of sewage over the whole surface of the filter.

(b) That the depth of the filter media be not less than four feet and preferably seven feet.

(c) That the filter media for effluents from the above form of tank be composed of hard broken stone or other suitable material, broken from one inch to two inch cubes.

(d) That the surface area of filtering media for domestic sewage be in proportion to the population using the sewers, i.e., in proportion to the amount of oxidisable matter present in the sewage.

Where a high degree of oxidation is required, the ratio of population to surface area of filter media should be approximately 17,500 persons to the acre (or 275 square yards per 1,000 population).

This corresponds to a rate of filtration of 1,750,000 imperial gallons per acre per day, or 155 imperial gallons per cubic yard per day (assuming depth of filter media to be seven feet) at a per capita flow of 100 imperial gallons per day.

The efficiency of filters will not be materially affected by increasing the rate of filtration during periods of storm to say three times the above stated rate, provided that the increase in volume is due to clear water.

In cases where the volume of dilution at the point of final discharge exceeds twenty times the volume of the sewage effluent, higher rates of filtration may be adopted.

(e) That the method or apparatus adopted for the distribution of liquid over the filter bed, shall ensure a uniform distribution over the whole surface.

(f) That all filter beds be drained at the base by the pipes or preferably by means of a false floor over the entire base of the filter.

(g) That sufficient provision be made for ventilation to allow of oxygen being present at all times and in all parts of the filter bed.

7. Humus Settling Tanks.

(a) That it is generally advisable to provide settling tanks for the removal of the humus which is unloaded by the filter beds from time to time.

(b) That such tanks be constructed in every case where disinfection of the final effluent is adopted.

(c) That humus tanks have a capacity equal to one forty-fifth of the dry weather flow in twenty-four hours, or equal to twenty minutes' flow calculated upon the twenty-four hours' dry weather flow taking place in fifteen hours.

(d) That it is desirable that such tanks have separate storage compartments as in the sedimentation tanks above described.

8.—Disinfection.

(a) That where chloride of lime is used for the disinfection of the final effluent, provision be made for weighing, measuring and storing the disinfectant in a dry covered building.

(b) That the period of contact between the disinfectant and the sewage be not less than fifteen minutes. An open pond or lagoon will serve this purpose.

9. Effluent.

That the effluent from the works be discharged into the watercourse or lake in such a manner as will ensure a maximum amount of dispersion.

10.—Housing of Tanks and Beds.

(a) That all parts of the works containing sewage under treatment be housed to conserve the latent heat of the sewage during low temperatures and to prevent fly nuisance in summer.

(b) That such covers be designed to enclose the minimum amount of space, at the same time giving room for accessibility and inspection.

(c) That with properly designed covers the introduction of artificial heat is unnecessary in sedimentation tanks, and may be obviated in filter beds.

(d) That provision be made in all covers for the access of light and for efficient ventilation.

11.—Laboratory.

That wherever the size of a municipality or other circumstance warrants its construction, a small laboratory be provided and equipped in which simple tests may be made of the sewage and effluents.

12.—Laying out the Surrounding Grounds.

That provision be made in the specifications and estimates for laying out, grading and improving the appearance of the surrounding grounds by terracing and seeding the slopes.

A rope railway 75 miles in length will be built in India. It will connect the rich country in the vale of Kashmir with the plains of the Punjab over the Himalayas. The line, it is claimed, will be the longest in the world, the present longest being 22 miles and located in Argentina. Sections will be 5 miles long and most of the spans will be 2,400 ft. The steel towers, some of which will be 100 ft. high, will be braced, and double 1½-in. cables, 9 ft. apart, will carry the steel cars. The carrying capacity of these cars will be about 400 lb. The estimated cost is \$1,600,000.

Exporting twisted steel reinforcement bars to the Pacific Coast by the Panama Canal from England and the Continent was discussed in a recent report from the United States Consul at Liverpool. This report quoted square or round bars at \$22.14 and \$29.19 f.o.b. at Antwerp and Liverpool respectively, plus cost of twisting, thus making it evident that there is no prospect for exporting English steel to the Pacific Coast at present. The report also states that although there are in the Liverpool district two large manufacturers producing reinforcement bars, most of the bars used in England are imported from the Continent.

Power Development at Saxon Falls*

Six-foot Pipe Line and Surge Tank, Both of Wood Staves, Receive Water Impounded by Multiple-Arch Concrete Dam

A Hydro-electric development of 1250 kw. has recently been completed on the Montreal River, four miles above its mouth. The power plant is located 17 miles northward of Ironwood, Mich., and 25 miles east of Ashland, Wis. This is the third water-power station put in operation by the Ironwood & Bessemer Railway & Light Company. The power is to be used for lighting and street railway operation in Ironwood and Bessemer, Mich., and Ashland and Hurley, Wis. The first installation of the plant comprises two 1,000-h.p. units, but the ultimate development will have double this capacity.

Hydrographic Conditions

The Montreal River, the boundary line between Michigan and Wisconsin, has a drainage area of 280 square miles above Saxon Falls, with a mean precipitation of from 32 to 40 in. per annum. At Saxon Falls the river has a drop of 64 ft. With a 26-ft. dam this fall, together with the rapids in the river above and below, gives a head of 135 ft. The dam is located 1,900 ft. above the power house. During the last year the minimum discharge of the river has been as low as 50 sec.-ft. The maximum discharge has not been ascertained, but from flood marks and other data it has been assumed that flood waters should raise the river 6 ft. above low stage, and the dam was, therefore, designed to take care of a rise of 8 ft.

Both the Montreal River and its principal tributary, the Gogoshungen, or west branch, have sites suitable for storage reservoirs, and four such locations have been surveyed, one on the headwaters of the Montreal River and three on the Gogoshungen. About 25,000 acre-ft. will be available in the four storage reservoirs.

The company has steam-power plants aggregating 1,500 kw. at Ashland, Ironwood and Bessemer, which were in operation before the water power plants were built. These stations are maintained as auxiliaries in case of breakdowns or other trouble at the water-power stations. Two of the plants are in the same building as the car barns; in the other is housed the principal sub-station. The cost of keeping fires banked under the boilers is, therefore, small.

Dam

The dam is 190 feet long. Its site is at the head

of the rapids and just below an enlargement of the river basin, where the banks are high and the stream is narrow; there is a fairly good sandstone foundation. The type decided on involves concrete piers 5 ft. wide, 44 ft. long and spaced 16 ft. on centers. The piers were designed for an ultimate height of 30 ft. Their front faces have been carried up only 18 ft. and made heavy enough to take care of the water pressure to that height. The piers were built of such shape that, when the dam is raised, they can be made longer and more massive. At present the space between piers is closed with timber stoplogs in five of the bays, the other four having vertical reinforced-concrete arches. One bay was built for a Tainter gate 11 ft. 7 in. wide by 17 ft. high. When the dam is raised it is intended either to build it of reinforced concrete or fill in between piers with vertical or inclined arches.

Underneath the dam a cut-off wall was sunk into the rock from 5 to 9 ft., according to the character of the stream bed. Holes 8 ft. in depth were put down on 4-ft. centres in the cut-off wall and the piers. In these holes were placed $\frac{7}{8}$ -in. square, twisted rods for anchorage. The concrete in the dam was placed from a concrete tower, 70 ft. high, located on the south side of the river. From this tower steel chutes conveyed the concrete to all parts of the dam. Gravel for concrete was obtained from the river bed and from a pit $2\frac{1}{2}$ miles from the site, from where teams hitched to sleighs hauled 3 cu. yd. per trip.

The headworks are equipped with a gate 7 ft. wide by 7 ft. 10 in. high, operated by a gate hoist so adjusted that the gate is lowered by gravity. Two men can raise it in about ten minutes. The trash rack is made of $2 \times \frac{1}{2}$ -in. bars spaced $1\frac{1}{2}$ in. apart. In order to avoid sharp curves in the pipe line the head gate is placed on the Wisconsin side of the river. The power house was built on the Michigan side because of a more protected location.

Pipe Line

The pipe line is 1,880 ft. long, made of $2\frac{1}{2}$ -in. hemlock staves cut to form a 72-in. diameter circle; 43 staves are required to form its circumference. The staves are cut to widths of $5\frac{5}{8}$ in. outside dimension and $5\frac{1}{4}$ in. inside. A kerf, 1 in. deep, is sawn into the ends of the staves for 10-gauge sheet-iron galvanized tongues. The pipe is banded with $\frac{3}{4}$ -in. mild



Relation of dam, pipe line and power house of Saxon Falls hydro-electric development.

* By C. A. Alderman in the Engineering Record.

steel bands with malleable iron shoes, spaced from $3\frac{1}{2}$ to 9 in. apart, depending upon the pressure, which varies from 8.84 to 15.75 lb. per square inch. Where the pipe rests on the ground timber saddles spaced 4 ft. apart are used to support it. These saddles also serve as forms for the construction of the pipe. The pipe is backfilled with earth to within 12 in. of its top. Where valleys are crossed the pipe rests on timber trestles composed of four 10 x 10-in. posts with cap and sill of the same dimensions. The bents are spaced 7 or 9 ft. on centers, according to their height. On these bents the pipe is supported by four 7×12 in. stringers.

Owing to the topography of the country it was necessary to place the headworks on the Wisconsin side of the river and the power house on the Michigan side, thus creating a river crossing. Nine concrete piers and two abutments, 3 ft. wide on top, 5 ft. on the bottom, and 16 ft. in length, were spaced 26 ft. 7 in. apart across the river. Two lines of 15 in. I-beams support the pipe on these piers. The line is fairly straight, with the exception of one curve of 128 ft. radius and a subtended angle of 36 deg. 40 min. near the headworks. It was, therefore, necessary to keep the hemlock staves in a steam box for about two days, after which period they were bent under pressure with a device rigged up on the ground.

Surge Tank and Penstocks

The 72-in. pipe line discharges into a 24-ft. diameter surge tank, 56 ft. high, built of hemlock staves



Seventy-two inch wood-stave pipe carried on longitudinal I-beam stringers.

sawed in a local mill. The lower 36 ft. are made of staves $3\frac{1}{2}$ in. thick, the staves for the upper 20 ft. being $2\frac{3}{4}$ in. thick. One hundred and sixty staves were required to form the circle. A reinforced-concrete casing, 12 ft. high, is built around the base of the stand-pipe. Considerable attention was given to the design of the casing to make it strong enough to withstand the water pressure. One 72-in. pipe enters on one side and two 60-in. steel pipes leave from the other side. Below the hole formed by the entrance of the pipe line the casing is reinforced by twenty 1-in. square, twisted rods placed in horizontal rings. At the top of the casing above the pipes are placed sixteen rods. Between the upper and lower rings there are a sufficient number of trussed rods placed vertically to transmit the stress to these horizontal rings. The staves of the surge tank are banded with $\frac{7}{8}$ -in. mild steel bands spaced from $3\frac{1}{2}$ to $7\frac{1}{2}$ in. apart.

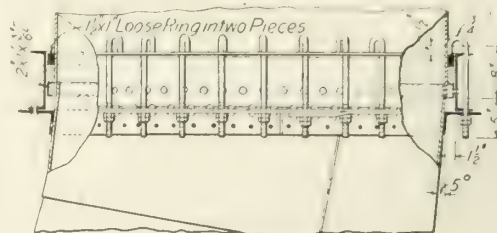
The 54-in. steel penstocks are of $\frac{5}{16}$ -in. metal for the lower 60 ft. and of $\frac{1}{4}$ -in. metal for the upper 57 ft. They are spaced $7\frac{1}{2}$ ft. on centers. One of them was furnished by the waterwheel manufacturers and the other was built at a local boiler works. Reinforced-concrete anchorages, 6 ft. square and 6 ft.

high, are placed underneath the penstocks and spaced 28 ft. $8\frac{1}{2}$ in. on centers. Two $\frac{7}{8}$ -in. rods extend from 4 to 6 ft. from each anchorage into the rock. Penstocks are on a 40-deg. incline with the horizontal.

Each penstock is provided with a 60-in. flutter valve at the top of the pipe line. A 6-in. relief valve is placed in the penstocks adjacent to the flutter valves.

Power House

The power house is 30 x 53 ft. and is built of concrete on the Michigan side of the river, about 200 ft. below the falls. It was placed on this side of the river

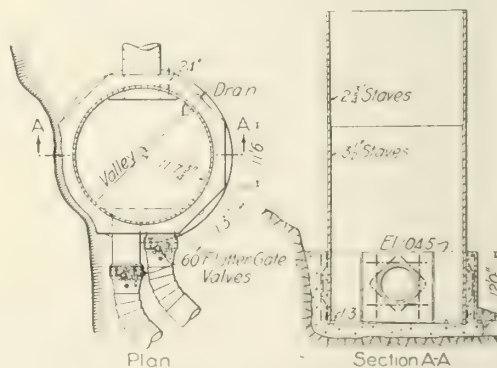


Detail of pipe expansion joint.

in order that it might be protected from floods, there being a projection of land into the river just above the power-house site. Both the power house and tail-race were excavated in the solid rock to a considerable depth.

The equipment consists of two horizontal 26-in., double-discharge Leffel waterwheels operating at 600 r.p.m. and using 83 sec.-ft. of water at a 135-ft. head to produce 1,000 h.p. Directly connected to the turbines are 625 kw., 2300-volt General Electric generators. The speed regulation of the units is accomplished by Lombard waterwheel governors. Two banks of three 200-kw., 60-cycle transformers step the current from 2300 to 33,000 volts. Two 14-kw., 125-volt exciters are belted to the generator shafts. One electrolytic lightning arrester, a switchboard and the necessary meters and recording apparatus complete the equipment.

It was decided to use this size of unit in order that full advantage could be taken of the stream flow, one unit being of the right size to take the minimum discharge of the river without storage and two units taking the discharge at mean ordinary stages. When storage reservoirs are built additional wheels may be installed of the same or larger size, depending upon



Wood-stage surge tank.

whether a part or all the storage capacity is at first put into service.

The work was done with company forces by day labor, camps suitable for the accommodation of one hundred men being maintained at the plant. All material and equipment were hauled by teams about three miles over a road constructed especially for the installation.

The New G. T. P. Hotel at Edmonton

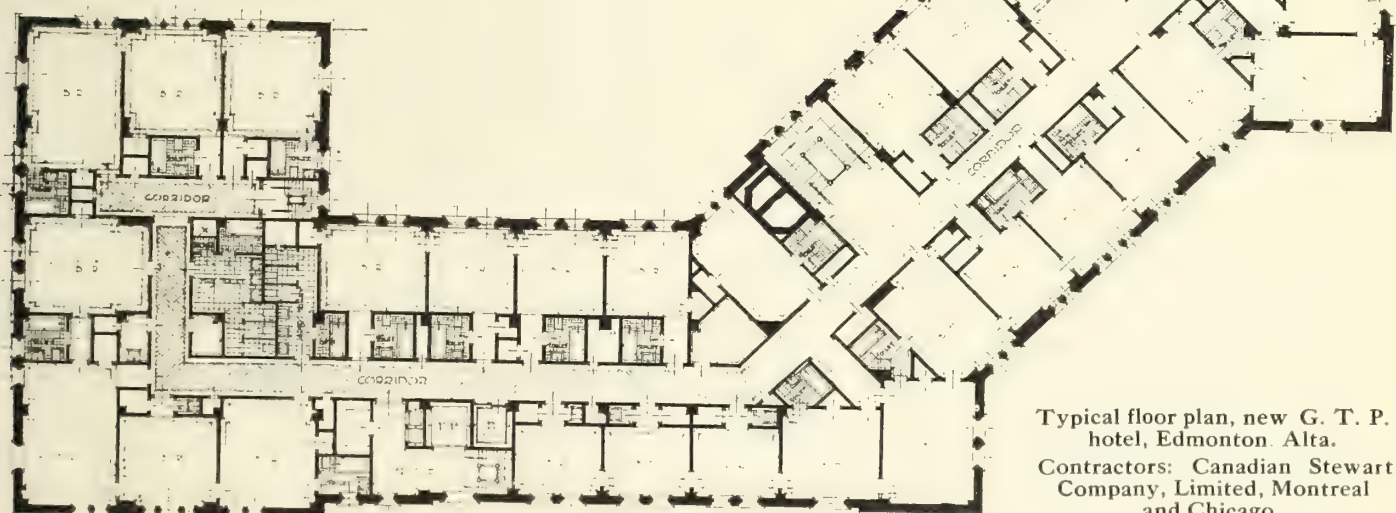
THE Canadian Stewart Company, Limited, of Chicago and Montreal, have about completed the erection of a large hotel in Edmonton for the Grand Trunk Pacific Railway. This building is the second of a chain of hotels which the railway is building throughout the length of the road. In plan the building is a modified L-shape, 240 feet long by 190 feet wide in its extreme dimensions. The site, while convenient to the business district, overlooks the valley of the Saskatchewan River and affords a fine outlook over the city. The building is eight storeys high, with the steep pitched roof characteristic of the French chateau. The ridge of the roof in the centre

iron were required for the column bases, and 2,750 tons of structural steel were supplied by the Dominion Bridge Company, Limited, of Winnipeg, and erected by the general contractors. The floor slabs are 4 inches of concrete, reinforced by Clinton wire cloth. The roof framing is structural steel, with steep slopes laid with 3 in. book tile and covered with 24 gauge copper, and deck slopes laid as floors and covered with a 5-ply tar and gravel roof. The exterior walls are, in general, 4 inches of stone, with 8 inches of brick backing, furred with 4 in. gypsum blocks and plastered, leaving a 2-in. air space between the outer wall and the furring blocks. Some 60,000 cubic feet of Indiana Bedford limestone were used, with a million and a quarter common bricks. All interior partitions are 4-



New G. T. P. Hotel at Edmonton, Alta.

Architects: Messrs. Ross & Macdonald, Montreal and Winnipeg.



Typical floor plan, new G. T. P. hotel, Edmonton, Alta.

Contractors: Canadian Stewart Company, Limited, Montreal and Chicago.

wing is 177 feet above the pavement. The exterior is entirely of limestone, with granite base course, the high copper roof heightening the coloring of the stone to a lively gray. There will be a total of about 225 guest rooms, with 125 private baths attached. The total cost will be one million dollars. The architects are Messrs. Ross & Macdonald, of Winnipeg and Montreal.

No particular difficulties were encountered in the excavations for the footings and except for the intricacy of the framing there were no particular engineering difficulties to overcome. The basement walls and the footings are of concrete and the superstructure steel, with concrete floors. One hundred tons of cast

inch gypsum blocks, except around stair wells and elevator enclosures, where 6-inch blocks are used. The exterior basement walls are furred with 2-inch blocks.

As will be seen from the typical plan, the centre wing is set back from the street corner, so that the entrance is approached through a loggia and court. On the entrance floor are the entrance porch leading into the main connecting corridor to the dining room and cafe on the left, and through a short lobby to the lounge and palm room on the right. The dining room is 50 ft. by 80 ft. and is to be finished with marble base, imitation Caen stone to the ceiling beams, with ornamental plaster ceiling. The doors and trim will be red oak. The cafe and bar are to have wood wainscott-

ing, with arched openings, enriched spandrel panels and plaster entablature and ceiling. The cafe and bar are both 30 ft. by 50 ft. The lounge is 25 feet wide and 85 feet long, and opens direct into the palm room—an octagonal chamber 50 feet in width. These rooms will be decorated to conform to the general scheme of the building. Practically all the rooms on the ground floor will have marble base, with imitation Caen stone wainscotting and plastered ceiling. The floors of the dining room and cafe will be maple, laid on cinder concrete fill. The corridor floors and rotunda floor will be red quarry tile. The other floors will be granolithic. On the mezzanine floor will be the ladies' drawing room, a writing room, two private dining rooms and a banquet hall, with private ante-room.

There will be five bedroom floors alike, each with 39 bedrooms, 24 private baths, and two public toilets.

On the sixth floor will be 19 rooms, 6 baths, and the laundry. On the seventh floor there will be but five rooms and on the eighth floor two rooms. All of the corridor and bedroom floors will be cement finished, the corridors to have an 8-inch mosaic tile border of appropriate design. The trim will be red oak, with red birch doors. The bathrooms will have 4 ft. 6 in. tile wainscotting, tile floors and plaster walls. All the stairways have cast iron risers and strings, with slate treads. The elevator enclosures are all kalameined metal.

The general contractors are the Canadian Stewart Company, Limited, of Montreal and Chicago, for whom Mr. Chas. Miller is the superintendent. The architects are Messrs. Ross & Macdonald, of Montreal and Winnipeg, for whom Mr. J. Beck is the inspector.

Concerning Concrete and Concrete Mixers

By James Casey

THE strength of concrete depends mainly upon the right selection of materials used, their natures, proportions, and thorough incorporation with each other. All aggregates should be clean, and the best are those that present rough and jagged surfaces, so as to provide a key. The sand should be coarse and sharp. If it is gritty to the touch, so much the better. The denser sands, being the heavier, are to be preferred. If more than five per cent. of clay or loam is present, sand should be washed, so as to get rid of excess. The sizes of the aggregates should be well graded, so as the mixed mass will, as far as practicable, be free from voids.

The heavier aggregates are preferred in the following order: granite, gravel, limestone, clay, sandstone, cinders. Porous stones (like sandstone) are relatively weak. In all cases, angular fragments are to be preferred, more particularly when the concrete is to be subjected to tensile strain, such as beams, warehouse floors, etc.

Concrete for Fireproofing

Slag and vitreous stones are best for fire-proofing purposes. Broken bricks and cinders are also good fire resistants. Cinders should be passed through screen before being incorporated. The size of stone depends upon where and how the concrete is placed. In heavy work, and when carefully deposited, stone that will pass through a three-inch ring are frequently specified. For floors, columns and reinforced construction, one-inch. For thin walls (4-inch partitions, for example), three-quarter inch. In extra heavy constructions, such as dams, bridge piers, etc., where the thickness is measured by the yard, stones of over three cubic feet are sometimes placed and with good results, with an economy of something like 25 per cent. In all such cases care should be taken that these big stones or rocks be kept at least two inches from all exposed surfaces. Work of this kind is, however, out of the order of regular practice, and the average contractor has seldom to handle it. We refer to it here to throw a sidelight, as it were, upon the entire problem.

The amount of cement to be used is determined by the voids between the larger aggregates. A simple way of determining the matter is to carefully measure and mix the sand and stone together and place in a

watertight receptacle. Shake well down, then add water slowly, by tilting against interior side of receptacle, so water may rise gradually from the bottom, thus avoiding air bubbles. When water shows upon surface, stop. The volume of the water thus added represents (theoretically) the volume, or bulk, of the cement required, allowing perfect mixture. The prudent engineer always adds a margin for safety.

It may be laid down as a general proposition that the denser and heavier the concrete, the better. The weight of a cubic foot of ordinary concrete may be roughly placed at one hundred and fifty pounds; cinder concrete—the strength of which varies from 50 per cent. to 75 per cent. of ordinary stone or gravel concrete—weighs about one hundred and ten pounds per cubic foot.

Concrete may be rich, ordinary or lean, according to the service for which it is intended, and location in which it is placed. Rich concrete (proportions 1:2:4) is very strong, and well adapted for all kinds of reinforced construction; floors, beams, columns, cisterns, silos, walls, etc. Ordinary (concrete proportions 1:3:6) is suitable for massive work, such as embankment walls, abutments, foundations, sidewalks, etc. Lean concrete (proportions 1:4:8) is weak in tensile strength, but will answer well enough under compression: heavy foundations, sub-base for driveways and other road beds, etc.

Mixing

No matter how excellent the materials used and the scientific accuracy with which they are proportioned, the concrete will not be reliable unless the aggregates have been thoroughly, that is to say homogeneously mixed, throughout the job. This is a basic fact from which there is no getting away, and the contractor who desires to earn a reputation for being dependable (a considerable asset when figuring with reputable concerns), should bear it constantly in mind.

The old-fashioned hand-mix is, at least in the larger and more profitable kinds of work, out of date. Hand-mix, however well done, is seldom perfect, and is always relatively costly. Human muscles, however willing, tire and fail; machinery never tires, and works unerringly if built upon right principles.

There are now available all kinds of mechanical concrete mixers, suitable for all sizes of jobs, and to be

obtained at moderate prices. A good mixer will pay for itself upon a single job of fair size, and leave a margin for profit.

Continuous and Batch Mixers

Aside from the vertical or gravity mixer, which has but a limited application, mostly in mining districts, and which consists of an enclosed shaft, in which are placed a number of interferences to divert the aggregates as they descend, a spray of water being introduced midway, concrete mixers may be divided into two general classes, continuous mixers and batch mixers. Quite a number of these mixers can be adapted to either form of delivery by the simple method of introducing a gate or cut-off, controlled automatically or by hand.

The best known continuous mixer consists of an open trough (placed horizontally, or with slight incline to delivery end to assist movement), fitted with a longitudinal shaft to which are attached blades and paddles, so arranged as to cut up and amalgamate the aggregates, and keep them moving onward. The materials are usually charged from a platform at rear end, by means of wheelbarrows or carts. Sometimes, however, in connection with heavy roadwork, materials are thrown direct from heaps ranged along the line of travel, upon a moving belt, by a gang of men engaged specially for that purpose. Water is introduced by means of an overhead sprinkling arrangement, delivery being at such points as may be selected. Sometimes the ingredients are mixed dry for the first half of the length of the trough. Mixers of this variety are equal to a large amount of work, two hundred yards a day being but a moderate output.

A small continuous mixer, with some novel features, has recently been placed upon the market. It claims a capacity of sixty yards a day. The mixing is effected in an open revolving dish, or pan, in which the materials are agitated by stationary plows, or blades. The desired proportions are delivered in the center of revolving disk through hoppers; cement and gravel from one side, stone from the opposite side. Under centrifugal action, the materials move gradually outward; as they do so they come under the action of the blades. The aggregates are first mixed dry, and then, about midway, they are wetted, the water being furnished from a tank. The mixer is provided with an automatic feed, and the discharge is effected at a given point in a continuous stream.

The popular rotating mixer now to be seen in operation everywhere, is substantially based upon the old cube mixer, with such additions as time and experience have suggested. This old-fashioned arrangement is merely a hollow steel box which revolves about a horizontal shaft that passes through it diagonally. The entire contrivance is mounted upon a stout timber frame. The box is charged at one corner, all outlets closed, aggregates revolved, and delivery effected at the opposite corner into a hopper.

The best known batch mixers to-day are of the well known rotary order. There are many differences in details between the various makes, but the underlying principles are substantially the same in all. In this line, as in other lines, competition has resulted in the survival of the fittest.

The modern rotary mixer consists of a revolving drum or double cone, the interior being fitted with strong deflecting blades, which mix and churn the aggregates in passage.

In some instances the service is direct, that is to say, the materials are wheeled onto a low platform,

which is portable with the outfit, and is charged directly into the end of the drum, where it is caught by the charging blades, which are part of, and rotate with, the drum. This solves the problem of low charging and dispenses with hoisting hoppers. The drum is supported by trunnion rollers which tread against the flare of the track bands. It is rotated by pinions meshing into the gear bands, the power being transmitted through the shaft on which these pinions are placed.

The double-cone mixer, though built upon much the same principles as the above, differs in several important particulars. The full charge is delivered at once by means of a side loader, which is filled while the preceding batch is being rotated in drum and delivered, thus avoiding all delays and securing a perfect uniformity in the batches. The fact that the loader bucket is fitted at the ground level considerably facilitates operations.

In a well devised mixer of the double-cone variety, the drum is in perfect balance, the batch swings on its own center, and the tilting axis is below the center of gravity. In some makes, the tilting motion (operated by means of a lever) is reversible, permitting discharge at any part of the revolution.

The drums of this variety of mixer are variously supported, according to the ingenuity and preferences of the individual makers. Power is transmitted either by means of gearing or by pulley and continuous band.

Batch mixers can be had in all sizes, from a capacity of $2\frac{1}{2}$ cubic feet up to two cubic yards and over. The sizes in greatest demand range from four cubic feet to thirty cubic feet. Sizes over the last, unless required for special purposes, are apt to prove unwieldy for the requirements of the average contractor, owing to weight and labor required in moving around, from place to place, and even upon the same job.

The smaller mechanical mixers can be worked by hand, if ordered that way. The medium and large mixers are operated by power and are furnished with boiler and steam engine, gasoline engine, or electric motor, as purchaser selects. Mixers are also furnished with water tanks and other attachments, as circumstances or special conditions may call for.

However carefully mixed, a certain amount of splashing attends the making of all concrete, and cement is hard upon machinery. To meet this trouble, some makers completely encase the more important parts so that dirt is absolutely excluded. The whole casing is kept constantly full of grease, keeping the running parts cool and efficient. As this grease is squeezed out of the bearings in a gradual and constant flow, it excludes all entrance of dirt. This adds materially to the life of the mixer and renders its operations smooth and regular.

Care should be taken that the rotatory is not unduly speeded up, so as to establish a centrifugal action in excess of requirements, and in a way to counteract the gravity action which is desirable.

Concrete is not merely a question of quantity; quality has also to be considered. A thinner floor of rich, homogeneous concrete will support a greater weight under tensile strain than a thicker floor of poorer and ill-mixed concrete under the same conditions.

It is claimed for some of the rotary mixers that they will deliver a finished batch every minute, and at a saving of fifty cents per cubic yard.

The daily capacity of a mixer can be figured out by the contractor for himself, by checking upon the job, watch in hand, the number of batches turned out in any given time. Multiplying the number of batches in

a day by the number of cubic feet in each batch will give the day's output in cubic feet. Divide by twenty-seven to reduce to cubic yards.

The demand for Portland cement concrete is steadily increasing, and is constantly introducing new features. There are reasons for this. Cement concrete is relatively cheap, easily made, and plastic so as to readily adapt itself to all kinds of forms. It calls for little skilled labor, which is a consideration in a trade in which wages are uniformly high, and competition keen. The material is impermeable, and a splendid weatherer.

The live contractor should, if he has not already done so, turn his attention to cement concrete work in all its shapes. Its use is not confined to the cities and larger towns. It has invaded the country, in every direction. It is now extensively used upon farms for the building of barns, silos, hog pens, etc. Its greatest developments have still to be witnessed.

In selecting a concrete mixer the following points should be considered: size, portability, simplicity of parts, price, balance, charging and delivery, homogeneity of product, visibility of mix, etc. The last is an important consideration, as it enables the man in charge to see how mix is progressing.—Building Age.

Excavating and Cost Data on the Panama Canal

It is said that the two chief reasons originally claimed in favor of the lock canal at Panama were: cheaper first cost and the shorter time required for construction. The original estimates were for a lock canal at a cost of \$139,700,000 to be constructed in $7\frac{1}{2}$ to 9 years; for the sea-level canal the cost was put at \$247,000,000, and the time of construction twelve to thirteen years. When it is further stated that the excavation required in the case of the lock canal was estimated at 95,955,000 cu. yds., and that for the sea-level canal of rather smaller section, at 231,000,000 cu. yds., some interesting facts are brought out. On the face of it the work involved in the sea-level canal seemed comparatively so great as to be almost prohibitive; yet instead of about 96,000,000 estimated, the lock canal will have necessitated by the time it is finished, excavation to an even greater extent than that originally estimated for the sea-level project. Again, though twelve to thirteen years were allotted to the excavation of 231,000,000 cu. yds., this length of time also being deemed to be prohibitive, practically this amount has been disposed of in about six years of serious work. Further, the cost of the sea-level canal, estimated at \$247,000,000, was thought to be excessive, although by July next year a sum of about \$299,000,000 had been expended on the lock project, the expenditure on construction works proper having been over \$185,000,000.

Building an 85-ft. chimney in seven days' working time is a feat accomplished by the Wiederholdt Construction Company, of St. Louis, Mo., on February 15. The chimney was built on the company's system of reinforced-tile concrete with a reinforced-concrete foundation, and was erected at the plant of the Eggers Milling Company, of Hermann, Mo. The company informs us that the chimney was actually built, including its foundation, in seven days' working time and was completed and put in service just 16 days after the receipt of the order. During its construction there occurred, moreover, the heaviest snowfall recorded in

ten years in St. Louis, and the temperatures were at no time higher than 20 deg. Fah. when work was started in the morning. The sand was heated before mixing and the tile was heated before placing. Fires were kept in the chimney constantly with all openings closed. The chimney has a total height of 85 ft., and is 3 ft. in inside diameter.

The New Civic Administration Building at Edmonton

The city of Edmonton have just completed and are occupying a six-storey office building, giving accommodation to practically all civic departments. The building is 72 feet wide, with a street frontage of 126 feet, and a rear length of 116 feet. It is of steel construction, with hollow-tile floors and partitions, and with exterior walls of face brick backed with 8-in. hollow-tile. There are 52,000 square feet of available office space. In addition to the usual civic offices, there is space for the Industrial Association, the Board of Trade, and other bodies, the office space totalling 52,000 sq. ft. The entire top floor is devoted to the City Engineer's office and in the basement is a municipal testing laboratory. The general contractors were Messrs. Purcell & Foote, of Edmonton, the building costing the city \$240,000. The building was designed by Mr. A. M. Jeffers, City Architect.

Mr. J. B. Holdcroft, A. M. Can. Soc. C. E., Vancouver, recently secured the Canadian patent for a machine for measuring and recording on a continuous strip the volume of material carried by a belt-conveyor. The record is made on the strip in such a manner that during the day's run the degree of uniformity of the load and its average proportion to the maximum may be seen at once by inspection, and at the end of any period the strip may be removed and the actual number of cubic yards which have passed the meter read off by taking the area of the curve inscribed on the strip.

An interesting lecture was given recently at the Conservatoire des Arts et Metiers, Paris, by M. Moutier, the Chief of the Technical Department of the Nord Railway Company, on "The Channel Tunnel." After recalling the prehistoric days when France and England were joined by an isthmus, M. Moutier said that soundings had shown that the bottom of the Channel was composed of a bed of homogeneous impermeable chalk to a depth of 50 yards, perfectly suited for the proposed tunnel. It was estimated that the tunnel could be completed in seven years. It would cost £16,000,000, and should give a return of 6 or 7 per cent. on the money invested in it.

The city of Des Moines, Iowa, has had some successful experience in renovating old brick pavements by converting them into asphalt pavements. Where the brick has a good concrete foundation only a 1-in. layer of sheet asphalt binder is added. A recent piece of work was the resurfacing of a section of Walnut street. The pavement was of brick with sand-filled joints, on an apparently secure foundation; but it had become very rough and uneven. An iron hook was used to remove the dirt from the joints and indentations, after which the surface was swept clean with brooms. A pavement surface-heater was then applied, the brick surface coated with hot liquid asphalt, and a 2-in. wearing surface of sheet asphalt applied.

Personal Mention

Mr. John Thorbourn, a well-known contractor and builder of Lindsay, Ont., died recently.

Mr. R. D. Farley has been appointed inspector of the work of constructing the new harbor at Kincardine, Ont.

Mr. Joseph Auguste Tessier, M.L.A., for Three Rivers, has taken office as Minister of Roads for the province of Quebec.

Mr. H. Doughty has resigned his position as superintendent of the Municipal Street Railway of Regina, his resignation to take effect April 30.

Sir Robert Perks, Bart., accompanied by his son, Mr. Malcolm Perks, arrived last week for the purpose of a business trip covering New York, Chicago, Montreal and Ottawa. Sir Robert is well known as one of the most prominent engineers and contractors in the world. He has been identified with many great undertakings, these including the Manchester Ship Canal and the port works at Buenos Ayres. He and his partner built the magnificent quay wall around Rio Janeiro Bay and carried out the vast land reclamation there,



Sir Robert Perks, Bart.

the work involving the expenditure of some \$25,000,000. He is now sharing the responsibility of extending the port at Buenos Ayres at a cost of \$35,000,000. Sir Robert takes a keen interest in the Georgian Bay Canal project—indeed he has linked this project with the tunnel under the English channel as constituting the two greatest public works now remaining to be carried out. A detailed biographical sketch of Sir Robert was published in our British-Featured issue of August 20, 1913.

Mr. Robert W. Angus, Professor of Mechanical Engineering, University of Toronto, lectured recently before a meeting of the Engineering Society of the University on the proposed Victoria Park water supply scheme for the city.

Messrs. Cammell, Laird and Company, of Birkenhead, Eng., supplied the turbines for the Canadian Pacific steamer St. George. The installation was made at the Robins drydock at New York under the superintendence of engineers from Birkenhead.

Mr. Charles Marsh Clay, who as a civil engineer in Manitoba assisted to build railroads in the wilds of Canada, died March 11, at Roxbury, Mass. More than thirty years ago

Mr. Clay gave up engineering to become head master for the Roxbury high school.

Mr. R. E. Palmer, M. Can. Soc. C. E., Chief Mining Engineer of the Rio Tinto Mines, in Spain, has been appointed Consulting Engineer of the company, with offices in London, Eng., where he will also act in a consulting capacity for several other companies.

Mr. William C. Kirkland, Principal Assistant Engineer in charge of drainage, Sewerage and Water Board, New Orleans, La., died in that city recently. Mr. Kirkland was born in Canada in 1861 and his early engineering experience was in railway work in the Dominion.

Mr. Nelson P. Lewis, Chief Engineer, Board of Estimate and Apportionment, New York City, recently delivered an illustrated lecture on "The Administration of Municipal Public Works" before the Graduate Students in Highway Engineering at Columbia University.

Mr. C. N. Forrest, Chief Chemist, Barber Asphalt Paving Company, Maurer, N.J., recently delivered an illustrated lecture on "The Essential Physical and Chemical Properties of Creosote for Wood Blocks" before the Graduate Students in Highway Engineering at Columbia University.

Mr. E. R. Doe, chief of the prominent contracting firm associated with his name at Victoria, B.C., died recently at the age of 47. Up to the time of his death he was engaged in constructing a steel bridge over Arbutus Canyon, B.C. During his career he successfully completed, in conjunction with his brother, a number of important engineering contracts in British Columbia.

Mr. Alexander J. McMillan of Vancouver, died March 3, after a brief illness. He was a civil engineer and for a number of years was engaged in railway construction in Oregon and California. At the time of his death he was chief construction engineer for the British Columbia mills, timber and trading company of Vancouver. He was born in Pictou, N.S., sixty years ago. He came to the Pacific coast in 1871.

Mr. George Westinghouse, famous engineer and inventor, passed away March 12 in a New York hotel, from heart disease. Mr. Westinghouse was in his sixty-eighth year. He was perhaps best known as the inventor of the air-brake which bears his name and which revolutionized railroading in this country. He founded many manufacturing companies in Canada, the United States and Europe, and his individual wealth and holdings have been estimated at \$50,000,000. It has been officially stated that his death will not cause any change of policy or operation in connection with any of the Westinghouse industries.

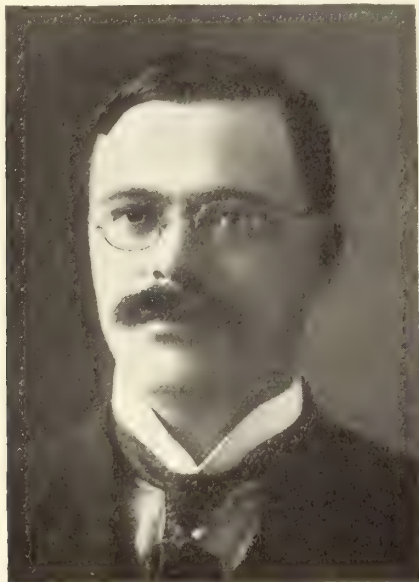
Mr. George Creford Browne, of Browneleigh-on-Hudson, South Nyack, N.Y., has intimated his intention of providing \$10,000 to form a fund for the provision of a scholarship in Architecture in connection with the Architectural Department of McGill University under the management of Professors Nobbs and Traquair. The first award will be made at the close of the present session, when \$500 will be forthcoming for a scholarship. Mr. Browne was formerly a prominent architect in Winnipeg. He was the youngest son of the late George Browne, who was, when he died in 1885, himself the oldest architect in Canada, having commenced practising at Quebec in 1830. Mr. Browne was born in Montreal and educated at the Montreal High School, and thereafter studied architecture in Europe. It is understood that one of his motives in founding this scholarship is the wish to perpetuate his father's name.

The firm of Fraser and Chalmers of Canada, Limited, Montreal, have been appointed Canadian agents for W. H. Allen, Son and Company, Limited, of Bedford, Eng., engineers and builders of steam and hydraulic machinery.

Canadian City Engineers

Mt. George D. Mackie, Moose Jaw, Sask.

Mr. George D. Mackie, whose appointment we recorded recently as Engineer-Commissioner of the city of Moose Jaw, was born in Perth, Scotland, and received his education at the Perth Academy and the Glasgow and West of Scotland Technical College. After receiving his training in the Perth municipal offices, he was appointed, in 1899, Assistant Road Surveyor of the County of Roxburgh. In 1900 he was appointed Town Engineer of Crieff, which has a population of 8,000, and while there—among other engineering works—installed a new gravity water supply at a cost of \$50,000. This work consisted of five miles of cast-iron piping, a concrete reservoir (capacity one million gallons) and slow sand filters. Also he built a sewage disposal plant on bacterial lines at a cost of \$30,000, laid out a public park and constructed many miles of concrete sidewalks. In 1905, Mr. Mackie was appointed Engineer to the Clydebank and District Water Trust. The population supplied by this body was over 40,000 and large quantities of water were sold in bulk to the shipbuilding yards in this district. While in Clydebank Mr. Mackie was associated with the laying of the first reinforced concrete water main in Scotland. This main was 15-in. in diameter and 11 miles long and was constructed to stand a head of 150 feet. It was constructed on the "Bonna" system and Mr. Mackie spent some time in Paris studying the construction of this pipe. Mr. Mackie made a



Mr. George D. Mackie, City Engineer of Moose Jaw, Sask.

long study of the best means of removing the peaty color from the Clydebank water supply, for which purpose he visited all the important slow sand and rapid filtration plants in Britain. The data collected by him were embodied in a paper read before the Institution of Municipal Engineers. In 1909 Mr. Mackie came to Canada and entered the employment of the John Galt Engineering Company, of Winnipeg and Calgary, for whom he installed a water supply system for Coldwater, Ont., sewers and street grading for Red Deer, Alta., sewerage system and water supply for Gleichen, Alta., and a sewerage system for the city of Cranbrook, B.C. Mr. Mackie was appointed City Engineer of Swift Current, Sask., in 1912, and leaves that appointment for Moose Jaw. He is

a member of the Institution of Municipal and County Engineers of Great Britain and is on the Council of the Canadian Public Health Association.

New President University of Toronto Engineering Society

Mr. E. D. Gray has been elected President of the University of Toronto Engineering Society. Mr. Gray, who is just winding up his third year's work in the Faculty of Applied Science, was born at Tillsonburg, Ont., in 1887, and is an Arts graduate of McMaster University, where he was prominent in both athletic and literary circles. Although only twenty-six years of age, Mr. Gray has had plenty of opportunity to familiarize himself with constructional prac-



Mr. E. D. Gray, the new president of the University of Toronto Engineering Society.

tice, he having worked actively in the field for the last eight summers. His first connection was with the T. & N. O.; later he became associated with Mr. T. S. Scott, formerly Assistant City Engineer of Toronto; and he spent last summer in Vancouver as superintendent for the Columbia Bitulithic Company on the last link of the "King's Way," an asphalt road from Vancouver to New Westminster, which has reduced the distance between these cities to twelve miles, and promises much, according to Mr. Gray, to promote trade intercourse between the two cities. In 1911, at McMaster University, Mr. Gray was president of the Literary Society. It is worthy of note that while he combines literary with engineering tastes he confesses to a predilection for the contracting business.

The Marion Steam Shovel in the New Welland Canal

In the excavation operations in progress on the new Welland Ship Canal, where a large number of powerful steam shovels and drag-line excavators are at work, it is interesting to record that on all four sections on which contractors are engaged the Marion Steam Shovel finds a place. All these shovels of the Marion type, as also the drag-line excavators now being installed, were furnished by Messrs. F. H. Hopkins & Company, dealers in railway and contractors' supplies, Montreal and St. Catharines, who are the Canadian representatives of the Marion Steam Shovel Company. The Hopkins firm have opened up an office and warehouse at St. Catharines, where a full stock of contractors' equipment and supplies is carried.

MAINLY CONSTRUCTIONAL

EAST and WEST — FROM COAST to COAST

EASTERN CANADA

The city council of Westmount, Que., has placed before the citizens its proposals for borrowing about \$1,200,000 for public improvements.

Mr. J. H. Dupont has been appointed building inspector and engineer of Lachine, Que., at a salary of \$2,700 a year. He takes up duties on April 1.

A mass meeting of the citizens of Montreal, called at the invitation of the chamber of commerce, unanimously endorsed the project of constructing the Georgian Bay Canal.

The Ottawa water bill, which provides that the expenditure by the ratepayers of the capital on the thirty-one-mile lake scheme, at a cost of \$8,000,000 is at present before the Private Bills committee of the Ontario Legislature.

The main building of the Standard Clay Products plant at New Glasgow, N.S., was burned down on March 12. The drying rooms and press plant were completely destroyed, the former being filled with pipe ready for the kilns at the time of the outbreak. The loss is estimated at about \$60,000.

Papers were filed on March 12 in the first expropriation proceedings in Welland County to acquire right-of-way for the new Welland canal. The property expropriated is five and a half acres, partly in the village of Humberstone and partly in the township, and is owned by Jacob E. Barrick. The price offered by the government is \$1,650.

Montreal City Council has returned to the Board of Control for the second time the recommendation for \$1,453,252 for indemnities and expenses in the St. Joseph Boulevard expropriation case. At the same meeting sums of \$312,919 and \$251,499 were voted respectively for the provision of a new park and playground and for land purchase and expropriation.

The Royal Museum of Archaeology, on the south side of Bloor street, Toronto, completed recently at a cost of \$400,000, was opened by H. R. H. the Duke of Connaught on March 19. The structure is 300 ft. long by 60 ft. wide, and the cost of construction and maintenance is borne equally by the Province of Ontario and the University of Toronto.

Work is progressing rapidly on the section of Danforth Avenue sewer from Winchester street to Logan avenue, Toronto. About 35 ft. of the sewer is mined each day, the bore having a depth and width of 7 ft., the sewer itself measuring 5 ft. in height and width. The work of construction is being carried out by the Godson Contracting Company and will be completed in a few weeks.

The Toronto civic works committee has approved of the principle of a scheme which includes extensions to Church street, Toronto and Teraulay streets, and the opening of Duplex avenue in North Toronto, the share of the cost to be met out of the general treasury amounting roughly to \$2,500,000. A recommendation has been made to the City Council in favor of estimating and assessing the cost.

The Toronto civic works committee has decided on a new proposal for the rounding of the corners at Bay and Queen streets. The streets will be widened 5 ft. on each side; Bay street 96 ft. on one side and 50 ft. on the other,

and Queen east and west streets a distance of 48 feet from the corners, which will be splayed. The new proposal, which is estimated to cost \$178,000, can be carried out as a local improvement.

In a lecture delivered in Toronto on March 14, Mr. C. E. Chambers, Parks Commissioner, gave a graphic description of the plans for beautifying ravines and open spaces in and around Toronto. He said that in conjunction with the Humber Boulevard plan and the scheme for making use of the Humber and the Don valleys, some fifteen miles of ravines across the city would be utilized, giving a result which would be second to none on the continent.

A civic plan for the future development of Berlin and Waterloo is at present on exhibition in the first-named city. The plan, which was prepared by Mr. C. W. Leavitt, Jr., a New York engineer, provides for a civic centre in Berlin to be bounded by an extension of Duke, Queen, Weber and Scott streets. It is proposed to encircle the twin cities by a boulevard to take in the entire park systems. The removal of the G. T. R. freight sheds is recommended and a Union station is proposed to be located in its place.

The new dry-dock for damaged inland waterways vessels is the most recent scheme advocated by the municipal Board of Trade for the upper portion of Montreal harbor. A resolution urging the enlargement of the present Tate's dock at the canal basin or the construction of a larger dock, has been despatched to the Minister of Railways and Canals. It was pointed out that the Duke of Connaught dry-dock is built primarily for ocean-going steamers and that the cost of its operation makes its use almost prohibitive for small craft.

After holding four meetings, a special civic committee of Montreal appointed to study the tramway report of Mr. G. R. MacLeod, railway engineer of the Council, have adjourned sine die. This report recommended the construction of subways and the improvement of the tramways service, and although the committee held four meetings practically no progress was made. In view of the aldermanic elections, it was felt that the question should be considered by a new committee and that the interests involved were too important to be discussed by a dying committee.

The new wharves which are being constructed at west St. John, N.B., two of which will be ready for use next winter, will not only have a face and surface of concrete, but warehouses of steel (the first of the kind in St. John) will be erected upon them. These berths will also be provided with grain conveyors connected with the new C. P. R. elevator. Not only the building of the timber substructure but of the concrete surface of the wharves involves a great amount of work, and it will give employment to a very large number of men throughout the summer and fall.

The Ontario Car Ferry Company has placed an order with the Polson Ironworks and Shipbuilding Company for the building of a new Car Ferry at a cost of \$500,000. The new ferry will be 318 feet long with 54 ft. beam and a draught of 20 ft. 6 ins. In addition to a carrying capacity of twenty-eight loaded freight cars, accommodation is provided for a thousand passengers. It will be constructed entirely of

steel and in design will be a duplicate of car ferry number one, which plies between Cobourg and Charlotte. The conditions of contract require that the new vessel be ready for service before the spring of 1915.

Captain Coleman Hinskley is again agitating for the reopening of the Wolfe Island canal. He had an interview with Mr. W. F. Nickel, M.P., recently, with regard to making another request to the Dominion Government to dredge out the old waterway between Kingston and Cape Vincent.

With the object of meeting the housing problem of Toronto, the board of health has decided to enquire into the conditions brought to light by Dr. Hastings in his monthly report. The members have decided to constitute themselves a commission and a solution will in due course be submitted to the city council. Controller McCarthy has expressed the opinion that workmens' dwellings can be erected in the city limits and rented at a profit for \$12 a month, if constructed on the English principle. The report on possible locations for the construction of such dwellings will be prepared by the assessment commissioner.

The Ontario Legislature has adopted a resolution urging upon the Federal Government the necessity for granting aid to develop the iron resources of the country. Discussing the question, Mr. R. R. Gamey pointed out that although there were large deposits of iron ore in Ontario and other provinces of the Dominion now lying idle or but little worked, the growing demand for iron and steel and also the demand for iron ore for smelting purposes were met largely by importation. He advocated a measure of assistance by the Parliament of Canada that would place the iron and steel industry on an assured footing.

The industries of Fredericton, N.B., are shortly to be added to by the addition of a concrete manufacturing plant. A company has been formed with the object of manufacturing concrete blocks and forms for building purposes. The new company is applying for a lease from the corporation and already plans are said to be maturing for the erection of several concrete buildings in that city. The new industry will be located in the old I. C. R. foundry and the head office will be at Gibson. Mr. H. C. McGrath, formerly masonry inspector of the I. C. R., will be the manager, and Mr. T. C. Burpee is appointed mechanical superintendent.

Damage estimated at \$150,000 was caused by a fire which destroyed the Woodbine Hotel, King street West, Toronto, on the evening of March 17. The rear portion of the building, which was a comparatively new section, was totally destroyed and the lives of five guests were lost. As a result of the outbreak the City Council has decided to have a report made by the Chief of the Fire Department in conjunction with the Acting City Architect, as to the present condition, from the point of view of the public safety, of all public buildings, schools, hotels, theatres and concert halls. A permanent and more efficient system of inspection is urged.

It is claimed that the new bridge to be erected this year to connect east and west St. John, N.B., and provide for street car as well as general traffic, will be the longest spandrel-arch bridge in the world. The foundations are nearly completed and preparations are now being made for work on the superstructure. It will be the third bridge across the famous Reversing Falls, as there are already a general traffic and a railway bridge, but the former can no longer accommodate the traffic, and street cars cannot cross it. With a continuous street car service over the new bridge it is anticipated that building operations on the west side will in future be much more extensive.

The report of the provincial roads department for 1913 has just been issued by Hon. J. E. Caron. Discussing the

government road policy, Mr. Caron points out that apart from the \$10,000,000 provided by the act of 1912, the government annually pays for roads improvements from \$300,000 to \$600,000. According to the by-laws passed by the municipalities, and adding the provincial roads, there will be built in the next five years under the act of 1912 nearly 2,000 miles of macadamized or gravel roads. Whereas twenty years ago only \$75 was spent by the government on roads improvements, in 1913 from July 1 to October 15 the government expenditure under this head was \$1,592,392.

A deputation from the Kingston shipbuilding company waited on the committee of the board of works of that city recently and urged that steps be taken to have a track extended from the Grand Trunk inner station to their plant. Mr. J. F. Sowards said that the company had an opportunity of securing two contracts which would total \$1,000,000, and which would mean work for 300 men for two years, but in order to secure this work the company required railway facilities. The Grand Trunk Railway Company were willing to lay a track (at the Shipbuilding Company's expense) from the inner station along Ontario street, but to render this project feasible the city would require to cut down the grade at William street.

Several firms have prepared plans and specifications for a reinforced-concrete viaduct across Bloor street, Toronto. About fifteen firms have also notified the city that they will tender on a steel superstructure. The situation now is that tenders for a concrete viaduct will be given equal importance with those for a steel one. It is unlikely that the Department of Works will be ready to call for tenders for the viaduct for a month or two yet, so great is the work in preparation of plans and specifications.

It is proposed to construct a pulp mill during the present year at Bathurst, N.B., to be ready for operation next May. A paper mill is also to be built which will produce a grade of paper that is in great demand and has hitherto been imported from the United States. The Bathurst Lumber Company, Limited, which has sawmills and controls 2,800 square miles of timber limits near Bathurst, has completed the organization of the Bathurst Pulp & Paper Company, Limited, which will have \$3,000,000 capital. The plans provide for the development of an extensive water power on the Nepisiquit River, and transmission of the power to the plant at Bathurst. Legislation to enable the company to proceed with its work immediately is being sought at the present session of the New Brunswick Legislature.

Considerable progress is being made in blasting, excavating and levelling of the foreshore from whence the new government breakwater and piers will extend seaward at Victoria, B.C. The new piers, to be known officially as piers 2 and 3 and also 1 and 4, are to be constructed before the harbor programme, decided upon by the Dominion Government, is completed. The contract for piers 2 and 3 was let recently at about \$2,250,000. Pier 2 is to be situated near the breakwater on the Ogden Point side. Its length extending straight out into the water will be 1,000 feet, and width 250 feet. Pier 3 will be 800 ft. in length on either side, with a width of 250 ft. Between the two piers on the landward side a concrete wharf 300 ft. long will be constructed. Mr. J. S. MacLachlan, Dominion District Engineer, is in charge of the work which will be one of the most extensive ever carried out on the Pacific coast.

With the awakening of Spring, Fredericton, the progressive city of the province of New Brunswick, comes forward with the announcement that a concrete manufacturing plant is to be established there. The field of the new company will be the eastern section of Canada. Mr. J. J. McCaffrey, proprietor of the Queens Hotel, Fredericton, is one of the promoters of the new concern. With him are asso-

ciated Mr. H. J. McGrath, of Moncton, formerly concrete inspector on the I. C. R., and Mr. T. C. Burpee, formerly engineer of Maintenance and Way on the Intercolonial. Mr. McGrath will be manager and Mr. Burpee mechanical superintendent of the new enterprise. Already the company have been given the assurance of a considerable amount of work, both structural and ornamental, and there are two travelling representatives in the field. The Maritime Province is experiencing a great awakening at the present time, especially in the construction line, and the opportunities for a concern of this kind seem exceedingly bright. The company has purchased the old I. C. R. foundry and will install up-to-date machinery.

WESTERN CANADA

The special stockyards committee of the Calgary City Council has formulated a tentative proposal for organizing the Union stockyards in East Calgary. The scheme will be submitted to the C. P. R. immediately as a basis for negotiations.

An order-in-council was passed recently, authorizing the immediate purchase of Lang's Cove drydock site at Esquimalt. The next step will be the preparation of plans and specifications, after which tenders will be called. The dock will be one of the largest in the world, its length being 1,150 feet, sufficient to accommodate the largest ship afloat.

A deputation from various Western Ontario points waited on the government at Ottawa recently to urge immediate action with a view to providing proper harbor and grain-handling facilities at Goderich and other Lake Huron ports. The Great Lakes disaster last autumn was used as one argument for a more generous provision this session for improving the harbor facilities on the lakes.

The construction of the new six-storey addition to the present mercantile establishment of the Hudson's Bay Company at Fort Edmonton, is reported to be well under way and steel will be placed shortly. Contractors in charge of the work are confident that the new building will be ready for at least partial occupancy during the coming summer. The present building will be raised one storey on all floors connected with the new addition, giving a total floor space of 70,000 sq. ft.

Mr. D. A. Thomas, a Welsh coal operator, has arrived in this country with the object of meeting speculators from Vancouver and Seattle, in order to discuss the charter they are expecting to obtain from the Canadian Government for the development of coal and mineral lands around the Peace River into Athabasca, B.C. The scheme is said to include the construction of a railroad into the territory from the Pacific coast northwest, passing through the Chamois ground hog coal field, entering a country comparatively unknown as to its mineral resources.

The work of connecting up the big water supply pipe and the three distributing mains in Regina, Sask., was successfully carried out on March 8. Heretofore the water pressure for domestic purposes has been produced by gravitation, the water coming from the reservoir at Boggy Creek, a distance of eight miles from the city, and having a drop of about 50 feet in transit. Now, however, in addition to the pressure from gravitation, the water will pass through the new pump, which is one of the largest of its kind in the West, having a daily pumping capacity of 5,000,000 gallons. The reservoir is over 200 feet in diameter and 25 feet deep.

The civic bridges and railways committee are reported to have rejected the tender of the Robert McLean Company, at \$248,900, which was the lowest, for the construction of the four bridges at Vancouver under the Hennibique system. The tender of the Union Contracting Company for the mushroom system in the plans of Mr. C. A. P. Turner, designing engineer for the bridges, amounted to \$299,800. The committee

took the view that to accept the tender of the Robert McLean Company would necessitate changes in the design, which would mean a delay of several months before the approval of the Great Northern Railway commission could be obtained.

Montreal Harbor Commissioners' Activities

DURING 1913 the Montreal Harbor Commissioners expended on capital account \$2,461,794 while, in addition, a large amount was spent out of reserve on maintenance and repairs. The annual report, just issued, states that the railway line was completed to high level along the river front from Molson's Creek to Tarte pier. Two permanent transit sheds were finished and opened for traffic on the Tarte Pier. The dry dock site, providing a large basin for the new floating drydock, Duke of Connaught, and a large area of made land for the shipyard, was advanced almost to completion. Owing to alterations in the plans of Canadian Vickers, Limited, a portion of the quay wall at the head of the basin had to be removed, and the work is being done by the Harbour Commissioners, at the request of Canadian Vickers, Limited, and at their expense, and the return wall for the slip is now constructed to half level. The south-east slip wall was concreted during the season and the south-west slip wall is now under construction.

New quay walls of standard cribwork substructure and concrete superstructure were completed, having a total length of over 2,200 lin. ft., and 2,000 lin. ft. partly constructed. Railway tracks to the extent of about four miles were constructed and an additional one mile improved and relaid. The removal of the artificial works at Moffat's Island was greatly advanced and its ameliorating effects on St. Mary's current towards the close of the season was very marked.

One of the important items of new work commenced was the construction of a large industrial wharf at Pointe-aux-Trembles. Another new work commenced was the construction of new transit sheds on the high level bulkhead wharves. A new electric hoist, with bridges connecting with the upper storeys of the sheds on the Alexandra Pier, was constructed during the season.

A commencement was made towards the re-construction of the superstructure of the wooden piers in the central part of the harbour, consisting of the substitution of concrete for the portion of the quay walls above low water level. This work is very difficult to accomplish, owing to the fact that work can only be carried on during the absence of ocean steamships. Sheet piling was driven along practically the whole of one berth and it is proposed to carry this work on to a certain extent each year, so that the whole may be re-constructed before the wooden walls entirely fall. The portion of the crib work under water is practically permanent and does not require re-building. The sheet piling is being driven along the face of this cribwork, so as to add to its strength and for increased support of the heavy concrete wall, and also to permit of deepening the berths.

The conduct of the enquiry into the break in the water conduit at Montreal by the Board of Control appears to have caused dissatisfaction among a considerable section of the citizens, judging by a resolution which was passed by an emergency meeting composed of the Board of Trade, Canadian Manufacturers' Association and the Builders' Exchange on March 10, alleging that the investigation is not being conducted in such a manner as to bring out the facts connected with the design of the intake conduit and aqueduct enlargement recently reported upon by Messrs. J. A. Jamieson, R. S. Lea and G. R. Heckle; urging the appointment of an engineer to advise the investigation commission, and also that evidence should be taken as to whether the conduit was built in accordance with the original plans and specifications.

Canadian Railroad Development

Track laying on the Lake Erie & Northern Railway has been completed across the Governor's road near Paris, Ont. The bridge work was carried out by the Hamilton Bridge Works.

The Minister of Railways, Hon. Frank Cochrane, has authorized a survey of the Intercolonial railways from Moncton to Halifax and Sydney, with a view to eliminating the present heavy grades, replacing light bridges with heavier steel structures, and ascertaining the cost and feasibility of a cut-off at Truro. In the memorandum issued by the general manager, Mr. Gutelius, it is asserted that by reducing the grades to a maximum of six-tenths the tonnage of the trains could be doubled, and by increasing the strength of the bridges heavier motive power could be used on this section of the line.

The contract has just been signed for remodelling a building at the corner of King and Germain streets for the St. John, N.B., headquarters of the Canadian Pacific Railway. It is a large brick building, but will be entirely remodelled and another storey added, so that the company may assemble there its various railway, steamship, telegraphic and other offices. Last year the company erected at west St. John a new million-bushel grain elevator, and the previous year they provided at the head of the harbor new freight sheds and a large amount of additional trackage. This year they will still further increase their trackage at west St. John, in connection with the two new steamship berths under construction there.

Montreal City Council has under consideration a report from the Board of Control regarding the proportion the city wishes to contribute towards the cost of elevating the Grand Trunk Railway tracks, within city limits, as decreed by an order of the Railway Commission in 1912. The law department have advised that the city should pay not less than \$1,000,000 or more than \$2,000,000 of the \$6,000,000 which it is estimated the elevation would cost. Of these amounts the cities of Verdun and Westmount are to be asked to contribute a portion to be deducted from the amount paid by the city of Montreal.

A bill to provide for alteration of the plans of the Kettle Valley railway line to permit the Kettle Valley Railway Company to reach the Hope Mountains from Penticton by way of Princeton instead of Aspen Grove is before the Legislature of Victoria, B.C. Under the original plans and bond guarantee the line was to be built from Penticton on the way west from Midway, via Osprey Lake and Aspen Grove, with a long narrow dip southwards between these two points in order to get over the low mountain range there. From Aspen Grove the line would run almost due west to Coldwater Junction and Otter Summit, there to meet a line extended south from Merritt, and also to make connection at the same point with the suggested line from Otter Summit and Coldwater Junction over the Hope Mountains to Hope on the main line of the C. P. R. The line south from Merritt has been completed and the alternative section over the Hope Mountains is now in the hands of the graders. The approval of the authorities of the revised plans of the Kettle Valley Line to eliminate the Aspen Grove route from its main line, was obtained some time ago, and now the Provincial Government has also given its consent. The bill to be brought down will also provide for a spur south from Princeton to the Copper Mountain mining camps and another spur from the Kettle Valley Line to Franklin's camp, near Grand Forks. It is understood that the Great Northern will be given run-

ning rights on the Kettle Valley and C. P. R., via Merritt, until the Coquahalla line is completed.

At the instance of the British Ambassador, Secretary Garrison has called upon the army engineers to report upon the possible effect upon the level of the Great Lakes of a measure now pending before the United States Legislature, which would permit the diversion of a greater amount of water from Lake Michigan into the Chicago Canal in connection with the proposed extension of the Chicago park system. The Ambassador, Sir Cecil Spring-Rice, in a note to the States Department said the proposed legislation would encroach upon Canada's navigation rights guaranteed by a treaty between the United States and Great Britain.

Industrial Notes

The Imperial Wire and Cable Company, Limited, and the Northern Electric and Manufacturing Company, Limited, have been amalgamated. The company will in future be known as the Northern Electric Company, Limited.

The Dominion Engineering and Inspection Company, of Montreal and Toronto, have been appointed to inspect the fabrication of the travellers to be used for placing the centre span of the Quebec bridge. These travellers will be manufactured by the Structural Steel Company, Limited, for the St. Lawrence Bridge Company.

The Great Western Railway Company of England has recently placed a contract with Herbert Morris, Limited, of Toronto, for the supply of all the Chain-Blocks which may be required during the year 1914. This is the thirteenth successive year in which the Great Western Railway Company has decided to purchase Morris Chain-Blocks.

The Industrial Engineering & Machinery Company, Limited, of Montreal, have just secured a contract for the complete installation of a large rock crushing plant, which is to be erected at Beauport, Que., for the Quebec Brick Company, Limited. The contract is being executed jointly by the Industrial Company and the Traylor Engineering & Manufacturing Company, of Allentown, Pa., the latter furnishing all the machinery. The plant is to be one of the largest and most modern in Canada, and will be electrically operated throughout. The quarry equipment, consisting of steam shovel, dump cars, locomotives and drills, is also being furnished by the Industrial Company. The shovel will be 3½-yard size, Marion-Osgood make, and especially adapted for rock work.

An engineering data book has been published which will enable users of power to select the correct Silent Chain Drives for their work and determine exact costs from list prices shown in the book. Besides giving complete engineering information on silent chain driving in simple and compact form. Data Book No. 125 describes many uses of silent chain for the efficient transmission of power and gives specific reasons and illustrations showing application in a large variety of uses. Link-Belt Silent Chain is a series of links connected by joints which consist of segmental case-hardened bushings and case-hardened steel pins. The chain is as flexible as a leather belt—as positive as a gear. Its rated efficiency is 98.2 per cent. on actual test. It will transmit any amount of power quietly. Over 200,000 installations, we understand, were drawn upon for the information contained in this data book. The book is the only work of its kind and consists of 112 pages, bound in flexible red cover. Copies can be obtained free of charge by addressing the manufacturers, Link-Belt Company, 39th Street and Stewart Avenue, Chicago.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Berlin, Ont.

Tenders addressed to the Clerk, A. H. Millar, will be received by the Board of Works and Sewerage Committee until 6 p.m., April 2nd, 1914, for laying cement walks, combined concrete curb and gutters, cast iron catch basin covers and manhole castings, concrete tile, sewer pipe, Portland cement, curb irons. Plans and specifications at the office of the City Engineer.

Beaconsfield, Que.

Tenders for the construction of a bituminous bound road will be received by C. L. Shorey, 475 St. Catherine St. E., Montreal, until 10 a.m. Monday, March 30th. Plans, specifications, etc., are at the office of the Town Engineer, Geo. Meakes.

Bertie Twp., Ont.

The Twp. Council has decided to construct a drain, plans and specifications of which are at the office of the Clerk, M. S. Pound, Ridgeway, Ont., who will receive tenders up to March 28th.

Edmonton, Alta.

Tenders have been received from the following for the supply of sewer pipe for 1914, to include pipes 6 to 24 inches with the various joints and fittings: Gorman, Clancey & Grindley, Ltd., 752 4th St., \$156,566; Standard Plumbing & Heating Co., Athabasca Ave. and 7th St., \$154,340 and \$147,568; J. B. Smiley & Co., 546 1st St., \$156,828; Can. Equipment & Supply Co., Ltd., 769 9th St., \$141,946, and Alta Clay Products Co., Medicine Hat, \$50,932 for part of contract.

Leamington, Ont.

Specifications for the laying of reinforced concrete pavements are at the office of the Town Clerk, R. M. Selkirk, who will receive tenders until April 6.

Ottawa, Ont.

The Ottawa Valley Motor Association is agitating for the construction of an automobile road following approximately the course of Rideau River most of the way from Prescott to Ottawa.

Peterboro', Ont.

The plans for the sewage disposal system have been approved by the Prov. Board of Health, with one or two exceptions. The changes suggested are being made. City Engineer, R. H. Parsons.

Parry Sound, Ont.

A by-law for authority to make extensions to the water mains at a cost of \$8,000, will be submitted to the ratepayers in April.

The construction of concrete sidewalks and roads at a cost of \$25,000, is being considered by the Municipal Council, and a by-law will be submitted to

ratepayers. A steam roller will be required if the work is decided upon.

Regina, Sask.

A by-law authorizing extensions to the waterworks system, at a cost of \$360,000 has been carried by the ratepayers.

The by-laws providing for the construction of storm water sewers and additions to the sewage disposal plant, involving an expenditure of \$252,000, were carried by the ratepayers on March 11.

The following park improvements are proposed by the City Council: Victoria Park, drinking fountain, post and chain fence; City Hall grounds, post and chain fence, two sanitary drinking fountains; Wascana Park, shelter building, lavatory, sanitary drinking fountain; Alexandra Park, shelter house with lavatory and shower baths, sanitary drinking fountain; Stanley Park, sanitary drinking fountain, post and chain fence; 3 lawn mowers, 500 feet of hose, a steel water tank and 100 park-seats will be required.

Richelieu, Que.

Tenders for macadamizing streets, etc., will be received by the Village Council until April 6th. Further information can be had from the Sec., A. Beique.

St. Anne, Que.

The construction of road and sewers at a cost of \$20,000 is proposed by the Municipal Council. Engineer in charge, J. A. Cloveau, Chicoutimi.

The municipal council is about to purchase road-making machinery, including a steam roller.

Toronto, Ont.

Tenders for the following pavements, etc., will be received by the Board of Control until March 31st: Asphalt on Agnes street, Bloor street, Blevins Place and Boulthbee, Canning, Cornwall streets. Asphalt concrete on High Park Ave.; and concrete curbing on Concord Ave.

The following are the particulars of the estimated cost of the projected new water works plant at Victoria Park. Lake crib, complete and placed, \$400,000, lake shaft, tunnel and shore shaft \$800,000, site and building \$500,000, pumping equipment \$380,000, boilers and stokers \$80,000, coal and ash handling machinery \$30,000, tracks and overhead equipment from York to pumping station \$35,000, motor and equipment for handling cars \$5,000, electric lighting unit at station \$2,000, twenty-six miles of distribution mains \$2,040,000, specials and valves \$60,000, filtration plant \$600,000, leveling, grading, etc., \$5,000, \$4,937,000; additional 10 per cent. for engineering and contingencies \$493,700, total \$5,430,700; six miles of distribution main—high level pumping station to West Toronto for part of which contracts have been awarded, \$353,000; additions to high level pumping station, and provision of steam reserve, sufficient to ultimate output of

this station, for part of which contracts have been awarded, \$250,000; grand total \$6,033,700. The location and system will be shortly dealt with by a Committee on Works.

The chairman of the Board of Control will receive tenders until March 31, for the construction of sewers on 17 streets, also Sorauren Ave., storm overflow sewer Sec. No. 2, and Midway Dist. Drainage Scheme Outlet. Plans are at the office of the Commr. of Works.

North Vancouver, B.C.

The following sanitary sewers are proposed by the Municipal Council. 4th St., estimated cost \$24,800; 13th St., estimated cost \$8,900.

Winnipeg, Man.

Tenders for extension to the water sub-station at May St., will be received by the Board of Control until March 30.

CONTRACTS AWARDED

Hamilton, Ont.

The contract for the construction of a sewer on Cambridge Ave. has been awarded by the City Council to J. D. Armstrong, 48 Burns St.

Oshawa, Ont.

The following contracts have been awarded by the town council. Can. Al-lis-Chalmers Co., Ltd., King and Simcoe Streets, Toronto, for the installation of 135 h.p. pump with 12 in. Venturi meter (complete) cost \$4,345. Oshawa Elec. Light Co. contract for power.

Ottawa, Ont.

The contract for the supply of asphalt has been awarded by the city council to the Barber Asphalt Co., at \$22.10 per ton.

Toronto, Ont.

The following contract for construction of sewers have been awarded by the Board of Control: National Contracting Co., 9 Garnock Ave., Enderby Rd., \$1,798; Lawlor Ave., \$19,888; Lyall Ave., \$1,288; Malvern Ave., \$3,458; Norwood Ave., \$1,798; Pickering Ave., \$3,198. Connolly, Agnew Co., 606 Avenue Road, Lexie Ave., \$720; Rosedale Heights Drive, \$2,549; Runnymede Road, \$28,200. McKnight Construction Co., 88 St. David Street, Swanwick Ave., \$1,309; Grant Contracting Co., 50 Front St. E., Glenwood Ave., \$1,374. W. R. Hunter, Bathgate St., \$2,365; Fairview Ave., \$1,579.

Windsor, Ont.

The contract for the supply of 600 ft. of steel intake pipe has been awarded by the city council to Geo. R. Cook & Co., Detroit, Mich.

Railroads, Bridges and Wharves

Brockville, Ont.

The Central Canada Coal Co. have had plans drawn for a dock built on piles to

be constructed on the river front. Elevator will also be built.

North Cayuga Twp., Ont.

Tenders will be received by the Township Council until noon May 2nd, for the construction of a concrete arch bridge over Teasdale Creek. Plans, etc., are at office of the Clerk, W. Teasdale, Cayuga, Ont.

Cocagne, N.B.

Tenders for the construction of a 380 ft. wharf will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. April 14th. Plans, etc., are at the office of Dist. Engineers, St. John and Chatham, N.B., Postmaster, Cocagne and at the Dept., Ottawa. Specifications are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Gainsboro Twp., Ont.

Tenders for the construction of two bridges will be received by the Clerk, S. W. Freure, Wellandport, or Reeve, Jno. A. Dalrymple, Bismark, Ont. The work consists of 2 bridges, each 1 span, 50 ft. by 14 ft., and 54 ft. by 14 ft., of iron superstructure; capacity of each 10 tons. The council will purchase cement, build abutments and put in floor.

Inverhuron, Ont.

A deputation from Bruce County has interviewed the Dept. of Public Works with a view to the construction of a breakwater and other improvements.

Knowlton Landing, Que.

Tenders for the reconstruction of the wharf will be received by R. C. Desrochers, Sec. Public Works Dept., Ottawa, until 4 p.m. April 7th. Plans, etc., are at the offices of Dist. Engineers, Sherbrooke, Que., Shaughnessy Bldg., Montreal, the Postmaster, Knowlton Landing, and at the Dept., Ottawa.

Laberge, Que.

Plans and specifications for the proposed bridge over the Chateau River are at the office of the town council Sec. Treas., Nap. Mallette, who will receive tenders until April 6th, for the construction of a steel bridge, span 250 ft. long. The contractor is to furnish materials and execute all necessary works for the construction of 2 concrete piers.

Montreal, Que.

The Montreal Southern Counties Ry. Co. will probably call tenders for overhead equipment and rolling stock for 15 miles of railroad from St. Cesaire to Granby, in about two weeks.

New Glasgow, N.S.

At a meeting of the municipal council it was decided to construct a steel trestle bridge over Potter's Brook at a cost of \$7,000.

Norfolk County, Ont.

Tenders will be received by James A. Bell, C.E., Court House, St. Thomas, until 4 p.m., April 2nd, for the construction of the concrete beam bridge over Little Otter Creek on Townline, Twps. of Bayham and Houghton.

Onondaga, Ont.

The construction of 2 bridges, 50 ft. and 37 ft. respectively, is proposed by the Onondaga Twp. Council.

Oneida Twp., Ont.

Tenders for the construction of three bridges will be received by the Clerk, John Senn, York, Ont., until March 31.

Prov. of Saskatchewan

Tenders will be received by C. D. Mackintosh, Div. Engineer, Moose Jaw, up to 12 o'clock noon April 1st, for supplying all labor and completing all work in connection with trenching and back-filling an 8 ft. steel pipe line. Plans and specifications are at the offices of J. G. Sullivan, Chief Engineer, Winnipeg; C. D. Mackintosh, Div. Engineer, Moose Jaw; W. T. Daniel, Resident Engineer, Regina; J. V. McNab, Resident Engineer, Moose Jaw, and K. A. Dunphy, Resident Engineer, Saskatoon.

St. Valier, Que.

The tenders for extension to the wharf were unsatisfactory, and consequently no award was made.

Vancouver, B.C.

A permit for the construction of the Broadway and Victoria Drive viaducts has been issued to the Great Northern Rly. Co. Grant, Smith & McDonnell, Ltd., Vancouver, are the contractors.

CONTRACTS AWARDED

Charlottetown, P.E.I.

The contract for dredging has been awarded by the Public Works Department to V. T. Bartram, Stair Building, Toronto, \$36,000.

Fitzroy Harbor, Ont.

The wharf contract has been awarded by the Public Works Dept., to Thos. & John Moran, Arnprior, Ont.

Fort William, Ont.

The contract for harbor improvements has been awarded by the Public Works Department to Thunder Bay Contracting Co., Port Arthur, \$365,000.

Moose Jaw, Sask.

The Can. Pacific Rly. Co. have awarded the contract for 300,000 ft. grading on 12 miles new railway south-east of Moose Jaw to Messrs. Wm. A. Dutton & Timson, 804 McArthur Bldg., Winnipeg.

Notre Dam Laterriere, Que.

The aqueduct contract has been let by Thomas Gauthier to Mr. Aubin, St. Prime, Que. Work is to start in the spring.

Nootka Island, B.C.

The contract for the construction of the wharf has been awarded by the Public Works Dept., to R. H. Wood, Port Alberni, B.C.

Rimouski, Que.

The contract for wharf construction and dredging has been awarded by the Public Works Dept., to Paul Raymond & G. A. Talbot, Rimouski.

Rocky Point, P.E.I.

The contract for the construction of the wharf has been awarded by the Public Works Dept., to Harvey D. McEwan, Morell, P.E.I.

Sault Ste. Marie, Ont.

The dock contract has been let by the Algoma Central & Hudson Bay Railways to A. G. Tweedie, who invites tenders for the supply of material.

St. Anne des Monts, Que.

The wharf contract has been awarded by the Public Works Dept., to John Burns, 219 Daly Ave., Ottawa.

Thurso, Que.

The wharf contract has been award-

ed by the Public Works Dept., to A. Belanger & Co., Papineauville, Que.

Vancouver, B.C.

The city council has awarded the contract for the construction of the 4 viaducts to the Union Contracting Co., Ltd., Vancouver.

Woodward's Cove, N.B.

The breakwater contract has been awarded by the Public Works Dept., to C. A. Huntley, Grand Manan, N.B.

Public Buildings, Churches, Schools, etc.

Ayr, Ont.

Tenders for the erection of a church and parish hall for the Ayr Anglican Church Board are invited by J. A. Mason, cor. Dundas and Burwell streets, London. Estimated cost \$10,000.

Alvinston, Ont.

Plans are in progress for the erection of a church and sheds for the Presbyterian Congregation, River St. The estimated cost is \$12,000. W. G. Murray, Dom. Savings Bldg., London, is the architect.

Berlin, Ont.

The remodelling of the heating system at the city hall is proposed by the city council.

Brampton, Ont.

The town council has passed a by-law to raise the sum of \$7,000 for additions to the primary school.

Calgary, Alta.

Plans for the new building for the Calgary University have been drawn and tenders will be called shortly. Two wings and large auditorium at rear is to be added later. Architects, Hodgson, Bates & Beatty, Grain Exchange Bldg.

Chatham, Ont.

Certain additions to "Queen Mary" school are being considered by the Board of Education, and plans and estimates of cost will be received by the Sec., Chas. E. Beeston, Harrison Hall, until April 6th.

Chilliwack Twp., B.C.

A by-law to raise the necessary funds for the construction of three schools has been passed, and tenders will be called shortly. Architect, Thos. Hooper, Winch Bldg., 739 Hastings St. W., Vancouver.

Drumquin, Ont.

Ellis & Connery, architects, Manning Chmbrs., Toronto, are calling for tenders for the erection of a church at Bethel, until April 1st. Plans are at the office of the architects and J. A. Hall, Hornby, R. R. No. 2.

Edmonton, Alta.

Plans are in progress and \$150,000 is being raised for the erection of the Robertson Presbyterian College in the University grounds.

Eel River Reserve, N.B.

Tenders for the erection of a school building will be received by Duncan C. Scott, Dept. of Indian Affairs, Ottawa, until noon, April 19th. Plans, etc., at the Post Office, Dalhousie and Campbellton, the office of the Indian Superintendent, at Buctouche, at Eel River School, and at the Department, Ottawa.

Enniskillen Twp., Ont.

Tenders for remodelling the school

will be received by Jno. Bradley, Copleston, Ont., until April 15th.

Kintore, Ont.

The erection of a church, at a cost of \$7,000, is being considered by the Presbyterian Church Congregation.

Lethbridge, Alta.

Plans are in progress for the erection of an 8-room school for the Separate School district at a cost of \$50,000. Tenders will be called about March 31st.

London, Ont.

The Board of Education has appointed A. E. Nutter, Dominion Bank Chambers, architect for the technical school.

The Public Library Board are about to purchase fittings for the east end branch library. Further information can be had from the Sec., W. O. Carson.

The proposed alterations to the Y. M. C. A. building, Burwell and Dundas St., have been abandoned on account of the lack of funds.

The Board of Education proposes to purchase a kindergarten equipment for Richmond St. N. school.

Medicine Hat, Alta.

Tenders will be called in about three weeks' time for the erection of a technical high school on 5th Ave., at a cost of \$300,000. Architects, McCoy & Levine, Hooper and Huckvale Block.

Moncton, N.B.

The municipal council is open to receive competitive plans for the erection of a new city hall; and also for a market building, site for which has been purchased.

Montreal, Que.

Tenders addressed to H. J. Silver, 36 Belmont St., will be received on behalf of the Protestant Board of School Commissioners, until Monday, April 6th, for furniture, etc., required for the high school. Further particulars can be obtained from S. H. Parsons, 55 St. Luke St., Montreal.

Plans are in progress for the erection of a school in St. James Ward for the R. C. School Comms. Architects, Marchand & Haskell, 164 St. James St., and Doucet & Morissette, 360 St. Catherine E.

Moorepark, Man.

Tenders for the erection of a church for the Moorepark Presbyterian Congregation will be received by the Sec., N. S. Thompson, up to noon April 26th. Specifications and plans are at the Canadian Bank of Commerce, Brandon, Man.

Ottawa, Ont.

The erection of a Post Office building on Overbrook street is proposed by the Public Works Department.

Plans for club house are being drawn for the Ottawa Canoe Club, Rockcliffe, by C. P. Meredith, 126 Sparks St.; estimated cost \$18,000.

Pembroke, Ont.

New tenders for the erection of the public library will be received by the Clerk, H. J. Fortier, until March 31st; estimated cost \$14,000. Architect, F. C. Sullivan, Castle Bldg., Ottawa.

Peterboro', Ont.

A new Roman Catholic parish is to be formed in the east end of the city, and church will be named "Church of the Immaculate Conception." It is proposed to

erect a church and rectory. Full information can be obtained from Bishop M. J. O'Brien.

Improvements to the ventilating system of the Collegiate Institute are proposed by the Board of Education.

Port Elgin, Ont.

Plans are being prepared for the remodeling of the Presbyterian Church. Mr. Geo. Falconer is the secretary of the building committee.

Port Arthur, Ont.

Plans for the erection of a club house at an expenditure of \$50,000 are being prepared for the Port Arthur Club, 229 Cameron street.

Port Coquitlam, B.C.

The Public Works Department has chosen a site for the erection of the post office; the building will cost about \$35,000.

Quebec, Que.

E. A. Dery, president of the School Comms. Notre Dame du Chemin, Belvedere Ward, will receive tenders until March 30th on the erection of a 3-storey school; estimated cost \$20,000. Architects, Ouellet & Levesque, 115 St. John St.

Plans are being prepared for the new City Hall fire station. The estimated cost is \$135,000.

Rankin, Ont.

Plans for the new St. Thomas' Church are being prepared by Architect, C. P. Meredith, 126 Sparks St., Ottawa.

Regina, Sask.

A site on Edgar St. and Victoria Ave. has been purchased by the Roumanian community who propose to erect a church at a cost of \$15,000.

Extensive additions to Regina College, estimated to cost \$100,000, are under consideration. Sec., D. J. Thom, 2220 16th Ave.

Ripley, Ont.

The erection of a 2-storey school building, at a cost of \$15,000, is being considered by the School Board.

St. John, N.B.

A site has been purchased on Douglas Ave. by the Seventh Day Adventists for the erection of a church building; estimated cost \$6,000.

Stratford, Ont.

Tenders on a club house for the Country Club are invited by Jas. S. Russell, architect, 21 Downie Street.

St. Catharines, Ont.

Tenders for the erection of an 8-room public school will be received by T. H. Wiley, architect, St. Paul street, until April 6th. Plans are at the office of the architect.

Toronto, Ont.

Tenders for all trades except heating in connection with the erection of a church on Grace St., for the St. Francis Roman Catholic Church will be received by A. W. Holmes, 10 Bloor St. E., until March 31st.

Toronto, Ont., Thornhill

Property Commr. D. Chisholm has purchased the Smellie Farm (200 acres) to be used as women's industrial farm.

Trafalgar Twp., Ont.

Plans for the Bethel Methodist Church are at the residence of the Sec., J. A.

Hall, R. R. No. 2 Hornby, who will receive tenders until April 1st.

Toronto, Ont., Fairbank

The Twp. Council has authorized the School Board to spend \$6,000 in grading grounds and fitting up the new building.

Warner, Alta.

Plans for the erection of a school, estimated to cost \$15,000, are being drawn by F. Palmer, architect, Dominion Bldg., Lethbridge.

Welland, Ont.

The county council will invite architects to submit competitive designs for addition and alterations to registry office as the lowest tender received, \$30,000, was excessive.

Westboro, Ont.

Richards & Abra, architects, Booth Bldg., Ottawa, are drawing plans for a new public school.

Weyburn, Sask.

Plans for an addition of 4 rooms to the Souris School are being drawn by Geo. J. G. Jarrett, architect.

Winnipeg, Man.

The Carnegie Trust will give a donation of \$70,000 towards the construction of 2 public libraries and the city will give the sum of \$8,000 to each.

Plans are in progress and tenders will be called in about six weeks' time for a school building for the Chapman School Dist.; estimated cost \$12,000. Architect, E. D. Tuttle, 709 McArthur Bldg.

Plans have been drawn and tenders will be called shortly for the erection of a public school on Selkirk St., at a cost of \$125,000.

Winnipeg, Man., St. James

Plans are in progress for the erection of a school for the Rural Municipality of Assiniboit. Architect, A. Melville, Builders' Exchange.

Woodstock, Ont.

McBride, Gilbert & Farncomb, Dundas and Richmond Sts., London, have been appointed architects for the erection of the new city hall.

CONTRACTS AWARDED

Belleville, Ont.

The contract for interior fittings at the post office has been awarded by the Public Works Department to Berlin Interior Hardware Co., Ltd., Berlin.

Brantford, Ont. (Echo Place)

The contract for masonry in connection with the erection of the Elm Ave. Methodist Sunday School has been let to J. Richards & Son, 115 Spring Street.

Carman, Man.

Snyder Bros., Portage la Prairie, have secured the contract for the erection of the public building.

Ethel, Ont.

The following contracts have been awarded in connection with the erection of the school building. Mason and plastering, Geo. Baker, Cranbrook; carpentry, Geo. K. Wahl, Listowel.

Fort William, Ont.

The following contracts have been awarded in connection with the alterations and additions to McKellar General Hospital. General contractor, Thos. Holesworth, c/o architect. Heating and plumbing, Superior Heating & Plumbing

Co. The contract for elevators is not yet let.

Hamilton, Ont.

The contract for painting the city hall, House of Refuge and Weigh Bldgs., has been let to James Boyd & Son, 741 Barton St. E., at \$791.

Leamington, Ont.

The contract for the erection of a parsonage for the Baptist Church has been let to A. S. Corlett.

Lethbridge, Alta.

The contract for interior post office fittings has been awarded by the Public Works Dept., to J. T. Schell Co., Kenyon St., Alexandria, Ont.

Montreal, Que.

The following sub-contracts have been awarded on the erection of the Mountain St. School for the R. C. School Commissioners: Stone, O. Fillion, 869 De St. Valier St.; brick, O. Archambeault, 575 Visitation Street; painting, L. Roger, 780 St. Andre Street; plumbing, J. J. Briard, 1277 St. Dominique St. The plastering contract will be let shortly.

Montreal, Que., Lachine

The contract for interior fittings at the post office has been awarded by the Public Works Dept., to J. T. Schell Co., Alexandria, Ont.

Paris, Ont.

The contract for the erection of a church for the R. C. Church Congregation has been awarded to John McGraw & Son, Temple Bldg., Brantford. Architect, Lindsay W. Wardell, 110 Hunter St. W., Hamilton.

Quebec, Que.

The contract for heating and ventilating at the post office has been awarded by the Public Works Dept., to W. J. McGuire & Co., Ltd., 332 Craig St. W., Montreal.

Stratford, Ont.

The contract for the erection of the new Knox Presbyterian Church has been let to Sutherland Constr. Co., 302 McKinnon Bldg., Toronto. Architects, Lindsay & Brydon, Trinity Sq., Toronto.

The contract for the erection of the Avon Ward School has been awarded to Pounder Bros., 21 Downie St., who have also secured the contract for additions to Church St. school.

Toronto, Ont., Richmond Hill

The school contract has been awarded to Geo. T. Browning, Yonge St., Aurora.

Toronto, Ont.

The following contracts for additions to Harbord St. School have been awarded by the Board of Education. Mason, Jno. McMurren, 319 Roxboro St. E., \$573; steel work, W. D. Beath & Son, 20 Cooper Ave., \$115; elevator ash hoist, Elevator Spec. Co., 36 Lombard St., \$516.

The contracts on the Davenport Road Police Station have been awarded by the Board of Control: Masonry, Witchall & Son, 163 Havelock St., \$23,187; carpentry, F. J. Murphy, \$7,480; plumbing, R. Jordan, 37 Hazelton Ave., \$4,865; painting, R. G. Johnson, 17 Galley Ave., \$849; tiling, Toronto Plate Glass Co., 91 Don Roadway, \$196; roofing, Douglas Bros., 124 Adelaide St. W., \$842; stable fittings, Vokes Hardware Co., 40 Queen St. E., \$475.

Winnipeg, Man.

The contract for extensions to the

police station has been awarded by the Board of Control to J. W. Astley, Engineer of Constr., at \$1,562.30.

Business Buildings and Industrial Plants

Arnprior, Ont.

The Arnprior Felt Co. propose to move their plant from Galetta if the town will grant a loan of \$10,000 and exemption from taxes, except school taxes, for 10 years. The following committee has been appointed to look into the matter and report, Messrs. S. R. Rudd, Thos. Moran, E. D. Osborne, and J. C. Williams.

Belmont, Ont.

Wm. A. Brown proposes to make certain additions to his store and residence.

Bathurst, N.B.

Plans have been prepared for the construction of a sulphite mill by the Bathurst Pulp & Paper Co., Ltd. Work will commence at once as the mill is to be completed by May 1st, 1915.

Calgary, Alta.

Plans for the erection of an ice plant and skating rink, at a cost of \$250,000, for the Crystal Ice Co., 417 Judge Travis Bldg., have been approved. The work is to start this spring, and be completed next fall. Architects for rink, Morrison & Co., Montreal; architects for ice plant, Artic Ice Machine Co., Canton, Ohio.

Cumberland, B.C.

G. W. Clinton has purchased a site on Dunsmuir St., and proposes to erect a theatre at a cost of \$10,000.

East Angus, Que.

Plans for the erection of a pulp mill and power house have been drawn for the Brompton Pulp & Paper Co.

Edmonton, Alta.

Work on the 10-storey store and office building on McDougall Ave., for K. McLeod, has been started again. Olson Johnson Co., are the general contractors.

Plans have been drawn for the erection of a factory and warehouse, on 5th St., for Harry V. Shaw, Prop. of the Edmonton Cigar Co., 548 2nd St.; estimated cost \$65,000. Architects, Magoon & MacDonald, 604 Tegler Block.

Eganville, Ont.

The building of a sawmill for the Standard Chemical, Iron & Lumber Co., will not be proceeded with.

Grimsby, Ont.

Plans for the erection of a storage building on Orchard street are being drawn for James Wray.

Hamilton, Ont.

The United Gas & Fuel Co., Sun Life Bldg., has purchased a building on Cannon St., which will be remodelled for offices, etc.

Kingsville, Ont.

Plans are now in progress for the erection of a factory for the Dominion Stove Co., at a cost of \$12,000. Architect, J. C. Pennington, Windsor.

Linwood, Ont.

The erection of a business block, to cost \$15,000, is being considered by J. G. Seip.

Medicine Hat, Alta.

Plans for a business block, to cost \$210,000, have been drawn by W. H.

Doty, Hull Block, by Trimble & Hay, Becker Bldg. The specification calls for 3-storeys, 120 ft. by 82 ft., concrete foundation, waterproofed, artificial stone, reinforced concrete brick and hollow tile construction, etc.

Montreal, Que.

Norcross Bros. Co., New Birks Bldg., who have the contract for the National Trust Co., Ltd., office building, 153 St. James St., invite tenders on all trades to close March 31st.

Jos. Sawyer, architect, 407 Guy St., expects to call tenders for separate trades about May 1st in connection with the erection of a candy and biscuit factory for Aetna Biscuit Factory, 245 Delorimier Ave.

Nanaimo, B.C.

E. J. Breseman, architect, Esplanade St., is inviting tenders on the erection of a store and office building, to cost \$12,000.

Ottawa, Ont.

L. N. Poulin, Ltd., Sparks St., have under consideration the erection of a 9-storey store.

Port Colborne, Ont.

J. Johnson has purchased a site on Charlotte St. for the erection of a business building.

Parry Sound, Ont.

A by-law will be submitted to rate-payers authorizing the expenditure of \$6,500 on a steel or concrete water storage tank of 150,000 gallon capacity.

Peterboro, Ont.

Mr. Thomas Barrie, of Barries, Ltd., furriers, has purchased a site on George St., for the erection of a store and factory.

Raymond, Alta.

The Wood Growers Assn. are about to erect a one-storey storehouse, 150 ft. by 50 ft., at a cost of \$10,000.

Regina, Sask.

A site on Broad St. has been secured by the Gutta Purcha Rubber Co., who propose to erect a factory at a cost of \$30,000.

A permit for addition to Victoria hotel, at a cost of \$10,000, has been issued to J. Ehman & Co., Victoria Hotel. W. Bonn, 2227 Quebec St., is the general contractor.

Sarnia, Ont.

The erection of a planing mill, at a cost of \$12,000, is being considered by E. C. Lawrence, Devine St. Machinery, engine, boiler, etc., will be required.

Prov. of Sask.

The Saskatchewan Co-operative Elevator Co., New Leader Bldg., Regina, contemplates erecting 25 grain elevators throughout Saskatchewan.

St. John, N.B.

The architect for the 2 stores and theatre to be erected for Arthur Mellick, 29 Duke St., is A. E. Anderson, 2595 Hutchison St., Montreal. Tenders are in, but the contract is not yet awarded.

St. Thomas, Ont.

The construction of a pasteurizing plant is contemplated by The Elgin Farmers, Ltd., recently incorporated.

Sudbury, Ont.

Tenders for the erection of stores, offices and apartments, on Cedar, for Wil-

son & Greenwood, will be received by W. H. Owens, 18 Baikie-Gill Block, until April 4th. Plans are at the office of MacLean Daily Reports, Ltd., 220 King St. W., Toronto.

Toronto, Ont. (Mt. Dennis)

The Canadian Kodak Co., Ltd., 388 King St. W., Toronto, have plans at the Toronto office for the erection of a factory for which they invite tenders.

Toronto, Ont.

The erection of a dairy building and apartments on Parliament St., is contemplated by Geo. Kerr. Architects, Shepard & Calvin, 3 Scott St., who has drawn sketch plans for a 3-storey and basement, 25 x 80, brick building.

Benj. Brown, 218½ Queen W., architect, invites tenders for all trades on the erection of a bakery and residence on Augusta Ave., for Mr. Senderowitz.

Wardville, Ont.

Plans being prepared by I. B. Whale, London, for the establishment of a poultry breeding station connected with the Department of Agriculture.

Winnipeg, Man.

Plans for the erection of an office building, McDermont Ave., at a cost of \$20,000, have been drawn for the North American Development Co., 522 McIntyre Block, by F. Ockleshan, architect.

Woodstock, Ont.

The following committee has been appointed to get information in regard to a new building for the Water, Light & Power Comsn., to be used partly as a storehouse. Mr. Butler, Chairman, John G. McBeath and B. McNichol.

CONTRACTS AWARDED

Blenheim, Ont.

A contract for the erection of offices, lodge room and garage, on Marlboro and Talbot Sts., has been awarded by Connor & Guilds to Connor & Cookson.

Edmonton, Alta.

A contract for the erection of stores and offices on Jasper Ave., has been awarded by Williamson Bros., to Nesbitt & Millar, 315 Jasper Ave. E.

Guelph, Ont.

The contract for the erection of the Sherer & Gellett factory has been awarded to Cowan & Walker, London Road.

Hamilton, Ont.

The following sub-contracts have been let on the addition to the carriage shop of A. Ross, 284 King St. E. Carpentry, G. E. Montrose, Stirton street; roofing, Dennis & Jocelyn, 13 Walnut street N.

The following sub-contracts have been awarded in connection with the erection of the King St. E., branch of the Merchants Bank of Canada. Roofing, Dennis & Jocelyn, 13 Walnut St. N.; plastering, T. Squires, St. Clair Ave.; painting, C. Kermath, 146 Victoria Ave. N.; plumbing, A. Crompton, 346 King William St.; electrical, Culley & Breay, 35 King St. W.

Bennett & Thwaites, Barton and Stirton Sts., have sub-let the following contracts in connection with the erection of stores and apartment house on King St. E. Tin work and roofing, Dennis & Jocelyn, 13 Walnut St. N.; plastering, T. Squires, St. Clair Ave.; painting, C. Kermath, 146 Victoria Ave. N.; heating and plumbing, Bloom & Brittain, 125 James St. S.; Electrical, Culley & Breay, 35

King St. W.; sewer, J. Wilson, 51 Sherman St. N.

Montreal, Que.

The contract for roofing in connection with the alterations to office building on Hospital St., for the Boxer Estate has been let to Eastern Sheet Metal Works, 137 Dorchester W.

Ottawa, Ont.

The contract for alterations to The Wallace Realty Co.'s premises, Queen St., has been let to D. Cuthbertson, 710 Echo.

Sherbrooke, Que.

A contract for the business block on Wellington street has been awarded by A. Chevalier to the Sherbrooke Construction Co., St. Francis St.

Toronto, Ont.

The contract for the erection of the Ford Motor Co. factory on Christie St. has been awarded to the F. J. Mark Construction Co., Birmingham, Alabama. Architect, Mr. John Graham, care company, Detroit, Mich.

Windsor, Ont.

The following contracts have been awarded on the garbage incinerator by the city council. Toronto Furnace & Crematory Co., Ltd., 111½ King St. E., Toronto. Wells & Gray, Windsor, for the erection of the building for the contracting company.

Residences

Berlin, Ont.

Plans for 25 workingmen's houses, on Peter St., at a total cost of \$67,500, have been drawn for Casper Braun, King St. W.

Tenders will be called shortly for the erection of 6 residences, on Simeon and Samuel Sts., for W. D. Euler and H. J. Sims.

Ford City, Ont.

The Gardner Building & Investment Co., 610 C. P. R. Bldg., Toronto, propose to erect a number of workmen's dwellings and invite estimates on heating, plumbing, lathing, plastering, wiring, gas pipe, hardware, building materials, etc.

Fort William, Ont.

Tenders for addition to the apartment block of C. A. Jenkins, Brodie north, are invited by R. E. Mason, architect, until March 30th; estimated cost \$15,000.

Grimsby, Ont.

Plans for a residence for Mrs. J. W. VanDyck have been drawn by Edward Mannell, architect.

Hamilton, Ont.

Tenders on the erection of a \$9,000 residence, on Delaware Ave., are invited by McPhie, Kelly & Darling, Bank of Hamilton Chmbrs., until March 28th.

Plans are being prepared for the erection of a \$50,000 apartment house on Bold St. by J. R. Smith, Spectator Bldg.

Hamilton, Ont., Dundas

Plans for the erection of two residences for A. B. Wilson, Dundas, have been submitted by McKay Bros., Hamilton.

Montreal, Que.

Recent permits issued included: to Francis Deslongchamps, 291 4th Ave., Viauville, for flats on Davidson St., to cost \$15,000; to Albert Hodina, 2584

Waverley St., for flat on Waverley St., to cost \$17,000; to Mrs. Lawrence, 2473 St. Urbain St., for 2 residences on Madison St., to cost \$8,000.

Montreal, Que., Maisonneuve

Plans for a residence on Pie IX. Ave., for O. Belanger, to cost \$10,000, are being drawn by Doucet & Morissette, 360 St. Catherine E. Separate tenders will be invited about April 1st.

Montreal, Que., St. Lambert

Plans for the erection of 2 pairs semi-detached residences on St. Lambert Park, to cost \$10,000, are being drawn by the Provident Freehold & Realty Co., B. 31, Board of Trade.

Moncton, N.B.

The authorities of St. Bernard's Church propose to remove the present parsonage and erect a stone or concrete house.

Medicine Hat, Alta.

Plans for a \$5,000 residence on 8th St. S.E., have been drawn by Alex. Johnston, View Court Apts.

Ottawa, Ont.

The erection of residences on Fifth St., at a cost of \$11,000, is being considered by D. A. Howard, 175 Strathcona.

Regina, Sask.

A permit for the erection of a residence, on Robinson St., to cost \$5,000, has been issued to O. G. Fisher, 201 Darke Block.

A permit for the erection of a \$5,000 residence on Athol street has been issued to A. Hines, 1929 Athol street.

Sarnia, Ont.

The erection of a number of residences is proposed by the Homeward Investment Co.

Toronto, Ont.

Plans for 6 attached stores and residences, on St. Clair Ave., to cost \$30,000, have been drawn for H. J. Atkinson, 34 St. Andrews Gardens, who will sub-let some work.

Plans for a 2-family residence, on Ossington Ave., to cost \$5,000 have been drawn for S. Ward, 98 Ossington Ave.

Plans for the erection of 9 pair residences, on Oak Crest Ave., have been drawn for A. Thomas, 37 Ashdale Ave., who will sub-let some trades.

Plans for 4 pair residences on Davenport Rd., have been drawn for W. Marks, 37 Yarmouth Gdns., who will sub-let some work.

E. W. Corby, 71 Shanly St., invites tenders for all trades except carpentry on 3 residences on Salem Ave.

Plans for the erection of 2 pair residences, on Lark St., have been drawn for John Trainor, 100 Westmoreland Ave.

Plans for the erection of 2 pair residences, on Rushton Rd. and Tyrell Ave., have been drawn for E. A. Elliott, 29 N. Markham St., who will sub-let some trades.

Plans for the erection of 3 pair residences on Kenilworth Ave., have been drawn for F. J. Cornell, 18 Hayworth Ave.

Plans for a detached residence, on Nina Ave., near Wells Hill Ave., to cost \$6,000, have been drawn for B. J. Case, 34 Nina Ave.

Victoria, B.C.

Plans are being prepared for fine re-

(Continued on page 80)

Tenders and For Sale Department

CITY OF BERLIN

Tenders Wanted

The Board of Works and Sewerage Committee will receive tenders addressed to A. H. Miller, City Clerk, up to 6 p.m., April 2nd next, for the following for the year 1914:

1. Laying Cement Walks.
2. Combined concrete curb and gutters.
3. Cast iron catch-basin covers and manhole castings.
4. Concrete tile.
5. Sewer pipe.
6. Portland Cement.
7. Curb Irons.

Specifications may be seen at the office of the City Engineer. The lowest or any tender not necessarily accepted.

A. H. MILLER,
City Clerk.

Berlin, March 17, 1914.



Department of Railways and Canals, Canada

Welland Ship Canal Section No. 4A

Notice to Contractors

Sealed tenders, addressed to the undersigned and marked "Tender for Section No. 4A, Welland Ship Canal," will be received at this office until 12 o'clock noon on Thursday, April 9th, 1914.

Plans, specifications and form of contract to be entered into can be seen on or after this date at the office of the Chief Engineer of the Department of Railways and Canals, Ottawa, and at the office of the Engineer in Charge, St. Catharines, Ontario.

Copies of plans and specifications may be obtained from the Department on the payment of the sum of fifty dollars. To bona fide tenderers this amount will be refunded upon the return of the above in good condition.

Parties tendering will be required to accept the fair wages schedule prepared or to be prepared by the Department of Labour, which schedule will form part of the contract.

Contractors are requested to bear in mind that tenders will not be considered unless made strictly in accordance with the printed forms, and in the case of firms, unless there are attached the actual signature, the nature of the occupation, and place of residence of each member of the firm.

An accepted bank cheque on a chartered bank of Canada, for the sum of \$5,000 made payable to the order of the Minister of Railways and Canals, must accompany each tender, which sum will be forfeited if the party tendering declines entering into contract for the work, at the rates stated in the offer submitted.

The cheque of the successful tenderers will be held as security, or part security, for the due fulfilment of the contract to be entered into.

The lowest or any tender not necessarily accepted.

By order,

L. K. JONES,
Asst. Deputy Minister and Secretary
Department of Railways and Canals,
Ottawa, March 21st, 1914.

Newspapers inserting this advertisement without authority from the Department will not be paid for it.—58047. 12-13

Notice

CITY OF SWIFT CURRENT

Sealed tenders, endorsed on envelope "Tenders for Cast Iron Pipe," "Tenders for Steel Pipe" or "Tenders for Gate Valves and Hydrants," as the case may be, will be received by the undersigned up to 5 o'clock p.m. of Monday, April 13th, 1914, for the supply and delivery F.O.B. Swift Current, Sask.:

- Contract "A-4"
246 Tons Cast Iron Pipe of various sizes.
7 Tons Cast Iron Pipe of Special Castings.

Alternative:
12000 lin. feet of 6-in. Steel Pipe.
1000 lin. feet of 8-in. Steel Pipe.
200 lin. feet of 10-in. Steel Pipe.
Specials of various sizes.

- Contract "B-4"
44 6-in. Gate Valves and Boxes.
8 8-in. Gate Valves and Boxes.
20 Fire Hydrants.

Specifications and forms of tender may be obtained on application to the City Engineer, Swift Current.

A marked cheque for an amount equal to five per cent. of the contract is required as a deposit.

The lowest or any tender not necessarily accepted.

GEO. D. ARNOTT,
City Clerk.

Corporation Offices,
Swift Current, Feb. 28, 1914. 10-12



Department of Militia and Defence

Long Branch, Ont.—Rifle Range

Notice to Contractors

Sealed tenders marked on the envelope "Tender for addition to Rifle Range, Long Branch, Toronto, and addressed to the Director of Contracts, Militia Headquarters, Ottawa, will be received until noon, the 28th March, instant, for certain additions to the Rifle Range at Long Branch, Toronto.

Plans and specifications may be seen and full information obtained at the offices of the Officer Commanding the 2nd Division, Toronto, and the Director General of Engineer Services, Headquarters, Ottawa.

Tenders must be made on forms supplied by the Department, and each tender must be accompanied by an accepted cheque on a Canadian Chartered Bank, for ten per cent. (10 p.c.) of the amount thereof, payable to the order of the Honourable the Minister of Militia and Defence, which amount will be forfeited if the party tendering declines to enter into the contract or if the successful tenderer fails to complete his contract in accordance with the tender.

The Department does not bind itself to accept the lowest or any tender.

EUGENE FISET, Colonel,
Deputy Minister.
Department of Militia and Defence,
Ottawa, March 6, 1914.

Newspapers will not be paid if this advertisement is inserted without authority from the department. H.Q. 18-35-14—57164. 11-12

TOWN OF HUMBOLDT PROVINCE OF SASKATCHEWAN

Notice to Contractors

Sealed tenders will be received by the Secretary-Treasurer until 8 p.m., Wednesday, April 15th, for the following works:—

- Contract "A"—Labor Laying Water Mains and Sewers.
Contract "B"—Pump House and Filter House.
Contract "C"—Furnishing Material for, and Erecting Water Towers.
Contract "D"—Furnishing Cast Iron Water Pipes.
Contract "E"—Furnishing Fire Hydrants and Valves.
Contract "F"—Furnishing and Installing Pressure Filters.
Contract "G"—Furnishing and Installing Pumping Machinery.
Contract "N"—Furnishing wood Stave Pipe.
Contract "O"—Laying Wood Stave Pipe.
Contract "P"—Constructing Ejector Station.
Contract "S"—Furnishing Sewer Pipes.
Contract "X"—Constructing Sewage Disposal Works.

Plans and specifications may be seen at the office of the Engineers, Toronto and Winnipeg, and at the Town Hall, Humboldt, on and after March 16th.

No tender necessarily accepted.

W. H. STILES, Esq., Sec.-Treasurer,
O. W. ANDREASEN, Esq., Mayor,
CHIPMAN & POWER, Engineers. 9-11



Tenders

Tenders addressed to the undersigned at Ottawa and marked on the envelope "Tender for Illuminating Oil and Oil for Kerosene Engines," will be received up to noon of the Twenty-eighth day of March, 1914, for the supplying and delivering about 150,000 gallons of Illuminating Oil and about 50,000 gallons of Oil for Kerosene engines, both made according to the specifications prepared by the Department of Marine and Fisheries.

The quantities mentioned herein are only estimates and the Department reserves the right to order larger or smaller quantities as required.

Specifications and forms of tender can be procured from the Collectors of Customs at Toronto, Petrolia and Sarnia, and from the Agents of this Department at Montreal, Quebec, St. John, Halifax and Charlottetown, and also from the Purchasing and Contract Agent, Marine Department, Ottawa.

Each tender must be accompanied by a deposit cheque equal to five per cent. of the total amount of the tender.

All tenders must be made on the tender form prepared by the Department.

No tender will be considered except for oil strictly in accordance with the specifications and put up in packages as called for in said specifications. Samples of the oils, cans and cases must be submitted.

The Department reserves the right to accept the whole or any part of a tender.

The lowest or any tender not necessarily accepted.
Newspapers copying this advertisement without authority will not be paid for same.

A. JOHNSTON,
Deputy Minister of Marine and Fisheries.
Department of Marine and Fisheries,
—56784. Ottawa, 16th February, 1914. 10-12

Tenders Wanted

Tenders will be received up to noon, **April 1, 1914**, for the erection of Bethel Methodist Church, near Drumquin, Ont.

Plans and specifications can be seen at the office of Ellis & Connery, Architects, Manning Chambers, Toronto, or at the home of J. A. Hall, Secretary Building Committee.

The lowest or any tender not necessarily accepted.

J. A. HALL,

12

Hornby, R. R. No. 2.

CITY OF SASKATOON

Tenders for Sewer Pipe and Specials

Sealed tenders, addressed to the City Commissioners, Saskatoon, and endorsed "Tender for Sewer Pipe and Specials," will be received up till noon on **Friday, the tenth day of April, 1914**, for the supplying of the following materials:—

19,500 lineal feet of Sewer Pipe in sizes 5-in. to 24-in. inclusive.

460 Junctions and Bends in sizes 8-in. to 24-in. inclusive.

The Corporation reserves the right to reject any or all tenders.

All information may be obtained on application to Junius Jonsson, Acting City Engineer.

F. E. HARRISON, Mayor,

Chairman of Commissioners.

Saskatoon, March 9th, 1914.

11-12



Tenders for Dredging

Sealed tenders addressed to the undersigned, endorsed "Tender for Dredging, Port Burwell," will be received until 4 p.m., **Thursday, April 9th, 1914**, for dredging required at Port Burwell, Elgin County, Ontario.

Tenders will not be considered unless made on the forms supplied, and signed with the actual signatures of tenderers.

Combined specification and form of tender can be obtained on application to the Secretary, Department of Public Works, Ottawa. Tenders must include the towing of the plant to and from the work.

The dredges and other plant which are intended to be employed on this work shall have been duly registered in Canada at the time of the filing of this tender with the Department, or shall have been built in Canada after the filing of the tender.

Contractors must be ready to begin operations immediately after the opening of the Welland Canal in the Spring.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Honourable the Minister of Public Works, for five per cent. (5 p.c.) of the contract price, but no cheque to be for less than fifteen hundred dollars, which will be forfeited if the person tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender be not accepted the cheque will be returned.

The Department does not bind itself to accept the lowest or any tender.

By order,

R. C. DESROCHERS.

Secretary.

Department of Public Works,
Ottawa, 20th March, 1914.

Newspapers will not be paid for this advertisement if they insert it without authority from the Department.—58046.

12-13

Change of Date

The final date for receiving tenders for the construction of Massey Bridge has been changed from noon, April 3rd, to six o'clock April 6th.

FRANK BARBER,
County Engineer.

Toronto, March 18, 1914.

12

Steam Rollers

Sealed tenders will be received up to 4 p.m. on **Monday, April 27th, 1914**, for an 8-ton Steam Roller, to be supplied to the Corporation of the City of Victoria, B.C.

Specifications may be secured from W. Galt, City Purchasing Agent, to whom all tenders must be addressed and marked "Tender" on outside of envelope. The lowest or any tender not necessarily accepted.

W. GALT,

City Purchasing Agent.

March 18, 1914.

12-14

Asphalt Plant

Sealed tenders will be received up to 4 p.m., **Thursday, April 30, 1914**, for a semi-portable asphalt plant for the Corporation of the city of Victoria, B.C. Specifications may be secured from W. Galt, City Purchasing Agent, to whom all tenders must be addressed and marked "Tender" on outside of envelope. The lowest or any tender not necessarily accepted.

11-15

To Contractors

Sealed tenders addressed to the undersigned will be received until 4 p.m., **Thursday, April 2nd**, for building a concrete beam bridge over the Little Otter Creek on the Townline between the Townships of Bayham and Houghton, about five miles south of Tillsonburg. Plans and specifications may be seen at this office or at the office of the County Clerk, County of Norfolk, Simcoe. Lowest or any tender not necessarily accepted.

JAS. A. BELL, C.E., County Engineer,

Court House,

St. Thomas, Ont.

12

Tenders for Sidewalks

Sealed tenders will be received by Mr. C. M. Webber, Town Clerk, for the construction of sidewalks for the year 1914, until 4 p.m. on **Thursday, April 16th, 1914**.

Specifications may be seen at office of Contract Record, 220 King Street West, Toronto.

Specifications and all other information may be received at office of Town Engineer, Welland. All communications seeking information regarding this work to be addressed to the Town Engineer.

Each tender must be accompanied with a certified cheque valued at 10 per cent. of total cost.

Tenders delivered after above hour and date for receiving shall be disqualified.

The Council do not bind themselves to accept the lowest or any tender.

By order of the Street Committee,

A. E. MASON, Chairman.

Engineering Department,
Welland, March 23rd, 1914.

12-13

Notice to Contractors

Tenders will be received by the undersigned up to **April 16th, 1914**, for the erection of double span Steel Bridge, 80 and 50-foot spans, and building Concrete Abutments and Pier for same. Plans and specifications can be seen at the undersigned at Bridgen. The lowest or any tender not necessarily accepted.

D. P. SHAW,

Reeve Moore Township.

Bridgen P. O.

12

Church Tenders

Sealed tenders, separate or in bulk, will be received by the undersigned until 6 p.m. on **Tuesday, the 31st inst.** for all trades (except heating) required in the erection of St. Francis' Church, Grace Street and Mansfield Avenue, Toronto. The successful contractors will be required to give satisfactory bonds. The lowest or any tender not necessarily accepted.

ARTHUR W. HOLMES, Architect,

10 Bloor St. East, Toronto, Ont.

11-12

Tenders for Paving

Sealed tenders will be received up to 7.30 p.m. **Monday, the 6th of April, 1914**, for the construction of Reinforced Concrete Pavement in the town of Leamington.

Specifications at the office of the Town Clerk, Leamington, Ont. The lowest or any tender not necessarily accepted.

R. M. SELKIRK, Town Clerk,

Leamington, Ont.

12

Tenders Wanted

Tenders wanted from all trades for the erection of a four-room brick school building for school section No. 4 Humberstone. Plans and specifications may be had on and after **March 12** at Mr. Chas. Ort's, Welland Junction, or at the office of the Architect, C. M. Borter, 102 Main Street, Niagara Falls, Ont. Tenders to be handed into the Secretary of the School Board, Mr. Chas. Ort, or at the office of the Architect before 6 p.m., **March 27th, 1914**.

The School Board reserves the right to reject any or all tenders.

10-12

For Sale

One standard gauge locomotive in operating condition. Cylinders 24 in. x 18 in.

The Jenckes Machine Company, Ltd.,
Sherbrooke, Que.

6-19

Second Hand Machinery For Sale

Offers will be received by the undersigned up to **Monday, April 20th, 1914**, for the purchase of the whole or any portion of the following Second-Hand Machinery, at the City Yards, Ross Avenue and Tecumseh Street, Winnipeg.

One 90 h.p. upright Steam Boiler and 50 ft. Smokestack.

Forty-eight wheeled Scrapers.

One 12 h.p. Vertical Gasoline Engine.

One 8 h.p. Vertical Gasoline Engine.

One Drake Concrete Mixer, operated by 16 h.p. Gasoline Engine.

One ½ cubic yard Chicago Mixer operated by Electric Motor.

One Non-reversible Hoist operated by 15 h.p. Vertical Steam Boiler.

Each bid must be accompanied by an accepted cheque or cash deposit for a sum equal to 10 per cent. of the total amount of sale.

The highest or any offer not necessarily accepted.

M. PETERSON, Secretary.

Board of Control Office,

Winnipeg, March 20th, 1914.

12-13

Quarry For Sale

Granite Quarry equipped for crushing and shipping. Well located for local market.

Address, Box 993, Contract Record, Toronto.
12-13

Wanted Employment

Construction Engineer with eight years' experience in designing and construction of bridges and reinforced concrete building desires to secure position. Excellent references. Box 991, Contract Record & Engineering Review, Toronto.
11-12

Wanted Employees

Engineering Sales Representatives wanted in Canada by large United States firm manufacturing sewerage disposal apparatus and other sewerage specialties. Apply Box 992, Contract Record, Toronto.
11-12

Equipment Wanted Second Hand

Dump Cars, 1 yd. and 2 yds.
Clam Shell Derrick Hoist, for excavating sewers and sand pits.
Dump Wagons.
Lackawanna or U. S. Steel sheet piling.

GODSON CONTRACTING CO.,
113 Manning Chambers,

11-12 Toronto, Ont.

Welland Needs 500 More Houses

Owing to the fact that several additional industries are under construction in Welland at the present time, which when completed will require the services of several hundred additional workmen, and,

Owing to the fact that Welland is becoming a very large manufacturing centre by constant increase in its list of manufacturing industries, and

Considering that construction on the new Welland Ship Canal is about to be undertaken,

WELLAND NEEDS 500 MORE HOUSES DURING 1914

The demand for workmen's homes within the limits of Welland is not only a present but a constantly growing one, and Welland has reached a point in its development where investment of money on a large scale in the building of houses is not only safe but profitable.

We the undersigned therefore invite investigation of the opportunities offered here to builders and investors and will gladly furnish particulars and statistics concerning Welland's housing problem.

JOHN GOODWIN,
Mayor of Welland.

W. J. HICKEY,
Pres. Board of Trade.

12-13

Bargains in Rebuilt Machinery, Located at Milwaukee, Wis.

Trench Machines

- 2 Parsons Trench Machines, cut trench from 27-in. to 60-in. wide and 20 ft. deep.
- 1 No. 0 Municipal Trench Machine, with gasoline power.
- 1 No. 1 Municipal Trench Machine, with steam engine and boiler.
- 1 No. 3 Municipal Trench Machine, with steam engine and boiler.
- 1 Buckeye Trench Machine, cuts trench 24 in. to 27 in. wide and 7½ ft. deep.
- 1 Buckeye Trench Machine, cuts trench 27 in. to 30 in. wide and 10 ft. deep.
- 1 Buckeye Trench Machine, cuts trench 24 in. and 36 in. wide and 12 ft. in depth.

Steam Shovels

- 1 45-Ton Vulcan Steam Shovel, mounted on railway wheels, 3 sets of engines.
- 1 25-Ton Vulcan Shovel, full circle, No. 1620, mounted on traction wheels.
- 1 30-Ton Little Giant Traction Shovel, 3 sets of engines, mounted on traction wheels.
- 1 No. 0 Thew Shovel full circle, mounted on traction wheels.

Miscellaneous

- 1 J. I. Case 10-Ton Road Roller.
- 2 50 Horse Power J. I. Case Hauling Engine.
- 1 25 Horse Power Reeves & Company Hauling Engine.
- 1 Lidgerwood Hoisting engine, 7 x 10, D.C.D.D., with boom swinger and boiler.
- 1 20 Horse Power Fairbanks-Morse Gasoline Engine, mounted on trucks.

Write us for prices and specifications.

Cream City Equipment Company,
400 Majestic Bldg.,
Milwaukee, Wisconsin.

10-12

Residences

(Continued from page 77)

sidence for Dr. Jas. D. McLane. Jesse M. Warren, 503 Central Bldg., is the architect, and the estimated cost is \$30,000.

Weyburn, Sask.

Geo. J. G. Jarrett will have plans ready for tendering about April 1st on a \$15,000 residence for D. Eaglesham.

Windsor, Ont.

C. A. Smith, having purchased a residence, will not build as was at one time probable.

Plans for a 2-family residence, on Hall Ave., are being drawn for Mr. Fenton, by Leybourne & Whitney, who invites tenders from March 26th until April 6th.

Winnipeg, Man.

The erection of an apartment block on Sherbrooke street at a cost of \$70,000 is contemplated by Peterson Bros., 45 Aikin Bldg.

A. Montgomery, 606 McArthur Bldg., is interested in a syndicate which contemplates building 60 residences this year.

R. G. Heron is considering the erection of a residence on Elm St. at a cost of \$6,000.

The erection of a residence on Selkirk Ave. is being considered by P. T. Alekno, 376 Selkirk Ave. Architect, M. Blankstein, estimated cost \$12,000.

Plans for a \$70,000 apartment block on Maryland street are being drawn for the North American Development Co., 522 McIntyre Block, by F. Ockleshan, architect.

CONTRACTS AWARDED

Blanshard Twp., Ont.

The contract for the erection of a residence for Wesley Spearin, Blanshard

Twp., St. Marys P. O., has been awarded to Stafford & Henderson, St. Marys.

Hamilton, Ont.

The contract for the erection of a residence on Mapleside Ave for A. S. Fraser has been awarded to W. Findlay, 317 Aberdeen Ave.

Montreal, Que.

A contract for the erection of 10 flats, on Kingston St., has been awarded by C. Lewis, 120 Monk Blvd., to Mr. Turgeon, Blue Bonnetts, Montreal.

Moose Jaw, Sask.

A contract for the erection of a terrace, on Athabasca St. W., at a cost of \$20,000, has been awarded to Western Construction Co.

The contract for the erection of an apartment block, on Ominica St. W., has been awarded by W. T. Black, 9 Moose Jaw Drug Block, to C. F. Jerram.

Oak Bay, B.C.

A permit for the erection of a \$10,000 residence on Suffolk St. has been issued to J. A. Turner.

Ottawa, Ont.

The contract for heating and plumbing in connection with the erection of the apartment block on Frank St., has been let to M. M. O'Connell, Gloucester St.

The contract for the erection of a residence on Strathcona street has been let to W. J. O'Connor, 495 Somerset St.

The contract for electric fittings in connection with the erection of residences, on Sussex St., for A. L. Florence, has been awarded to W. R. McCallum & Co., 498 Gladstone.

The following additional contracts have been awarded on the residence on Monkland St., for E. I. Shuttleworth. Plastering, Murphy & Morrow, 139 Waverly St. Electrical, J. A. Ellacott, 411 Bank St.

Toronto, Ont.

The contract for the erection of a detached residence, on Hurondale Ave., has been let by G. C. Flint, 196 Carlaw Ave., to J. S. Baldwin, 106 Bee St.

The contract for the erection of a detached residence, on Don Cliffe Drive, for L. E. Thomas, 11 Oriole Gardens, has been awarded to F. Holland, Roselawn Ave.

Vancouver, B.C., Shaughnessy Heights

The following contracts have been awarded on the erection of a residence, on Marguerite St., for Geo. A. Walkem. Architect, R. Mackay Fripp, 429 Pender St. W., Vancouver. General contractors, Vancouver Machinery Depot Ltd., 1155 6th St. W. Sash and door, Cedar Cove Sash & Door Co., 2321 Powell St. Lumber, Alberta Lumber Co., 790 6th St. W.

Power Plants, Electricity and Telephones

Guelph, Ont.

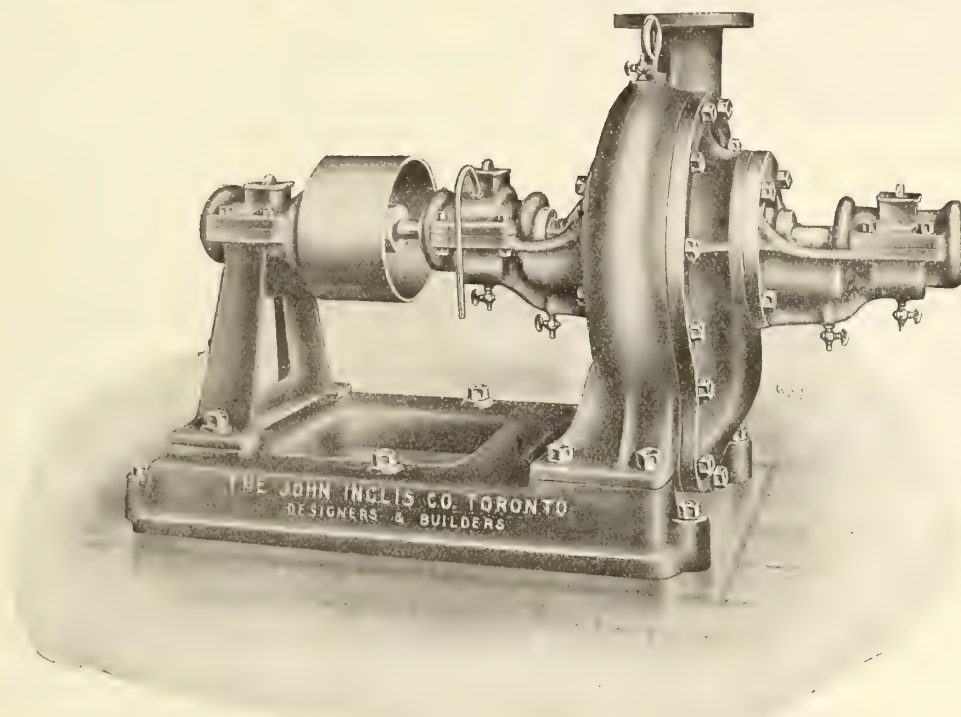
The city council has passed a resolution asking the Prov. Hydro-Elec. Commission to furnish estimates on the construction of an electric railway from Guelph to Orangeville.

Kamloops, B.C.

The following recommendations involving an expenditure of \$32,000 have been made by C. North, superintendent of the Light & Power Dept. The purchase of additional equipment for another unit

(Continued on page 82)

PUMPS



Horizontal Belt Driven Turbine Pump supplied the University of Toronto.

THIS Pump is hydraulically balanced against end thrust and in addition has a water cooled thrust Bearing. The Pump is arranged so that it may be operated with guide vanes or without for demonstration purposes. Oil ring bearings, Hydraulic Balance and water cooled thrust bearings are standard for all "Inglis" Turbine Pumps.

We make pumps of all kinds for any service.

Write us for prices.

The John Inglis Company, Limited

ENGINEERS AND BOILERMAKERS

14 Strachan Ave.,

Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

to the municipal light and power plant. One Francis turbine horizontal shaft in spiral casing, double arrangement for 1,400 h.p. with full size blow-off valve \$8,000; 1 oil pressure governor \$1,000; 1-750 kw. direct connected 3-phase generator with switchboard and exciter \$8,000; building and foundations, with tail-race, \$6,000; 300 ft. new 6 ft. flume and rebanding portions of that at present installed \$3,500; unloading and erecting \$2,500; 1 blow-off valve and installing on existing unit \$3,000.

Montreal, Que., Outremont

Tenders will be received by the Sec.-Treas., E. T. Sampson, until 2 p.m. April 1st, for supply and delivery of 450 street lighting standards, with globes, reflectors, insulators, sockets and accessories complete. Price to be given per standard, including delivery. Specifications are at the office of the Town Engineer, Outremont.

Ottawa, Ont.

Tenders will be received by the Chairman of the Electric Dept. until March 30, for the supply of electric meters, transformers, copper wire and sundry supplies.

Regina, Sask.

By-laws authorizing extensions to electric lighting and power system and to the street railway, at a cost of \$160,000 and \$250,000 respectively, have been carried by the ratepayers.

Provision for an electric signal system connected with the police department has been included in the estimates.

Tenders will be received by Commr., L. A. Thornton, until March 28th, for (1) weatherproof copper wire; (2) insulators, top ins, etc.; (3) cross arms; (4) pole line hardware; (5) cedar poles; (6) pole type transformers; (7) street lighting equipment; (8) cut out mast arms; (9) integrating wattmeters. Specifications, etc., at the office of the engineer.

Revelstoke, B.C.

A by-law will be submitted to the ratepayers for authority to install an electric power plant at a cost of \$35,000.

Victoria, B.C.

The council has authorized extensions to the present street lighting service and additions to the electrical equipment. Arc lights will be installed on a number of streets.

CONTRACTS AWARDED

Hamilton, Ont.

A contract has been awarded by the city council to W. D. Beath & Son, Ltd., 20 Cooper Ave., for the supply and installation of 1 electrical coal handling plant at City Hospital boiler house, cost \$936.

The contract for machinery and electrical equipment for the east end incline has been awarded by Geo. F. Webb, Wentworth St. S., to Canadian Allis-Chalmers, Ltd., King & Simcoe Sts., Toronto.

Moose Jaw, Sask.

A contract for an electric elevator has been let by the Public Works Dept., to Otis-Fensom Elev. Co., Ltd., H. O. 50 Bay St., Toronto, Ont.

Miscellaneous

Calgary, Ont.

Tenders are invited by the City Clerk, J. M. Millar, for a quantity of paper insulated lead covered cable for underground use, delivery f.o.b. cars Calgary. Tenders will close April 1st, a deposit of \$300 is required. Plans and specifications are at the city hall.

Preston, Ont.

The town council is considering the purchase of cement.

St. Mary's, Ont.

The purchase of fire apparatus including new hose reel, fire hose, etc., is being considered by the town council.

Petrolea, Ont.

Dr. C. O. Fairbank has plans in progress for the construction of a natural gas line from Oil Springs to Petrolea.

Hamilton, Ont.

Tenders will be received by the Mayor until April 8th, for the supply of an 80 h.p. motor tractor.

Brussels, Ont.

C. Pope & Son, Seaforth, have secured premises, and will require machinery for manufacturing specialties.

Stratford, Ont.

The council has decided to submit a by-law for authority to purchase a steam fire engine, a service ladder truck, and a motor-driven combination chemical and hose wagon, at an estimated cost of \$15,000.

Chatham, Ont.

Canadian Concrete Products Co., Ltd., Richmond St., require estimates on 5,000 sq. ft. tar and building paper.

Moncton, N.B.

The city council is about to purchase 900 ft. of rubber fire hose.

Montreal, Que.

Tenders will be received at once by Geo. R. Lightall, 303 Quebec Bank Bldg., for building materials for certain buildings on St. Catherine E., Frontenac, Harbour, Demontigny Sts., etc.

Ruthven, Ont.

Bruce Fox & Sons are in the market for a large quantity of cement for new chimneys, also tile and concrete blocks.

Toronto, Ont.

The Fire Chief, John Thompson, has included in his estimates the sum of \$100,000, for 2 motor operated pumping engines and combination hose wagon and chemical wagons; 8 motor combination chemical engine and hose wagons; 1 motor hook and ladder truck, and 2 tractors for aerial trucks.

CONTRACTS AWARDED

The following additional contracts for municipal supplies have been awarded by the Board of Control. Brass castings and fittings, Chadwick Bros., \$21,000; lumber, red and white pine, M. Bresser & Sons, \$27.95 per 1,000 ft.; sewer pipe, Hamilton & Toronto Sewer Pipe Co.; sewer brick, Allman Bros.

Ottawa, Ont.

The ice breaker contract has been awarded by the Dept. of Marine & Fisheries, to Canadian Vickers Co., Ltd., Montreal, \$998,583.

Montreal, Que.

The following sub-contracts have been awarded in connection with the erection of stores on St. Catharine St. W., for the Dom. Sq. Land Co. Ornamental iron, J. H. Sticht & Co., Longueuil; carpentry, Wm. Rutherford & Sons, Atwater Ave.; terra cotta, David McGill, Bleury St.; roofing, Sibley & Huot, 34 St. Martin St.; store fronts, Kawneer Co.

Calgary, Alta.

The contract for installing the elevator at the examining warehouse has been let to Turnbull Elevator Mfg. Co., Ltd., 126 John St., Toronto.

Business Notes

Brechin, Ont.

The Brechin Hotel and the residence of Dr. Gilpin have been destroyed by fire. Loss \$15,000.

Ottawa, Ont.

The 3-storey building on Rideau St., occupied by the Rideau Electric Co. has been destroyed by fire; loss \$20,000. The premises will be rebuilt.

Sarnia, Ont.

The factory of the Jno. Goodison Thresher Co., 236 Mitton St., has been destroyed by fire. Over 200 threshing outfits being completely destroyed.

Strassburg, Sask.

The following were the principal sufferers in a recent fire. Jos. Lavalley, store, loss \$7,000; J. M. Quan, restaurant, loss \$5,000; A. Nagel, harness shop, loss \$5,000.

Verwood, Sask.

A recent fire inflicted losses on the following: Verwood Harness Co., store, loss \$3,000; Guthrie & Russel, store, loss \$5,000; Parks Lumber Co., lumber yard, loss \$3,000.

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Merchants Bank Chambers,

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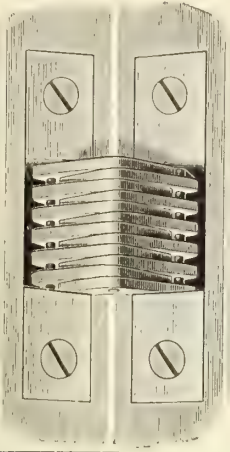
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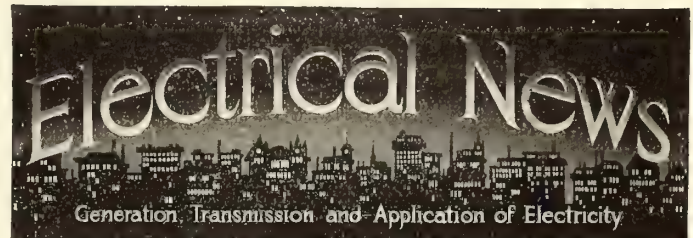
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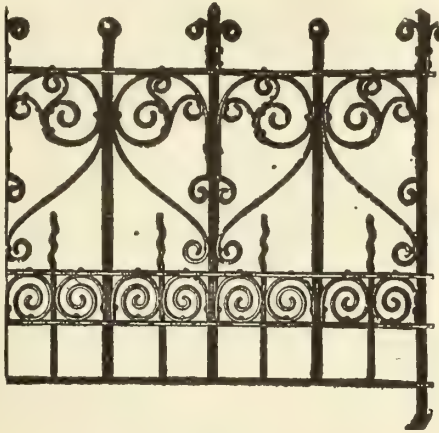
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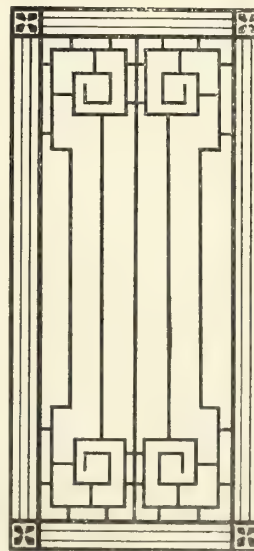
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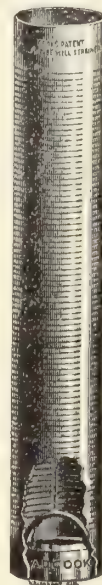
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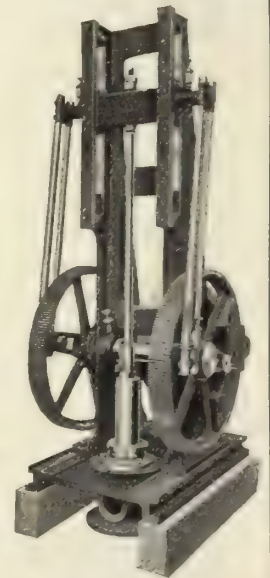
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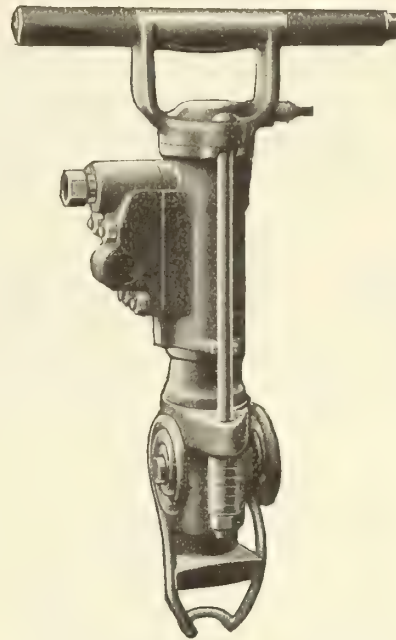
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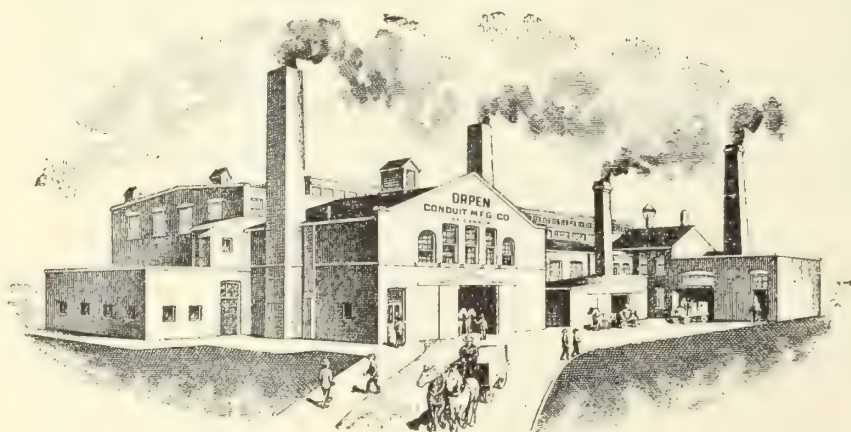
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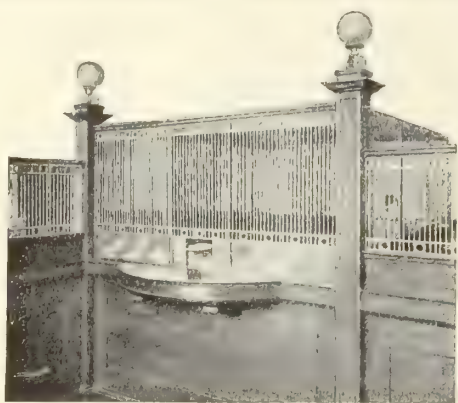
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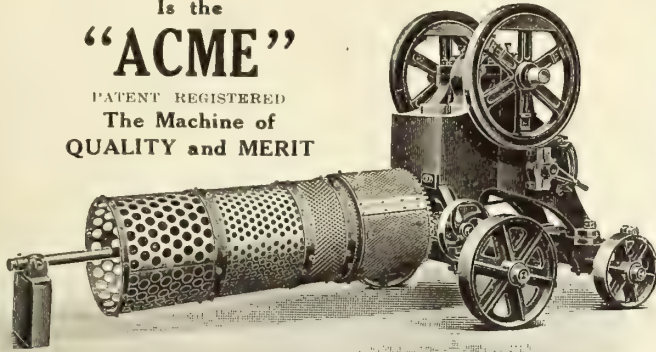
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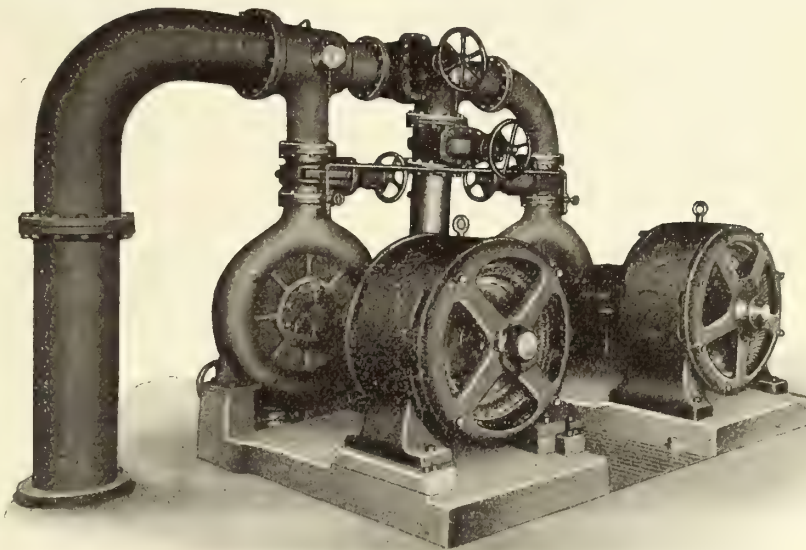
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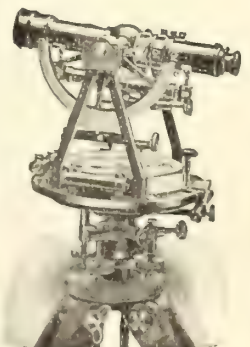
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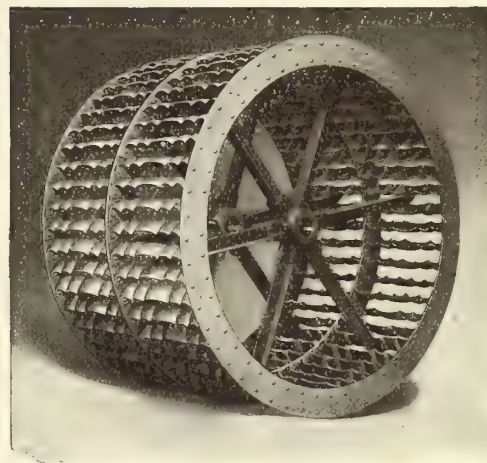
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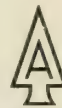
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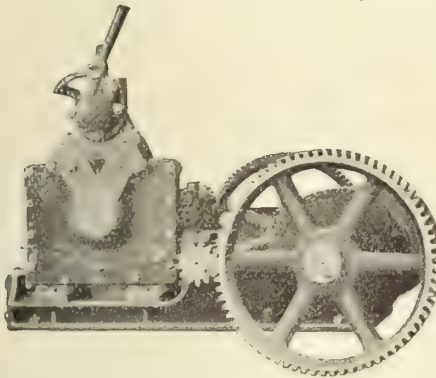
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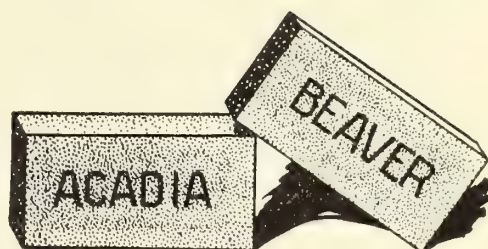
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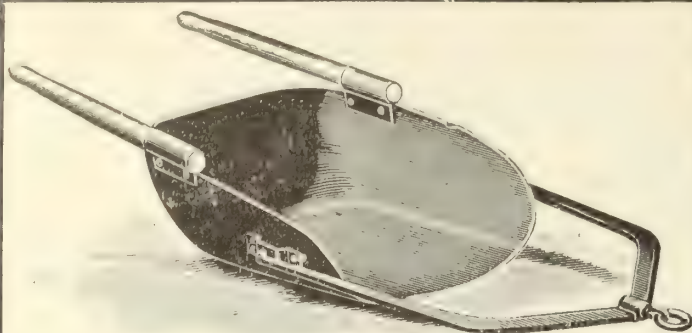
struction, is reasonable in price, and absolutely wea-
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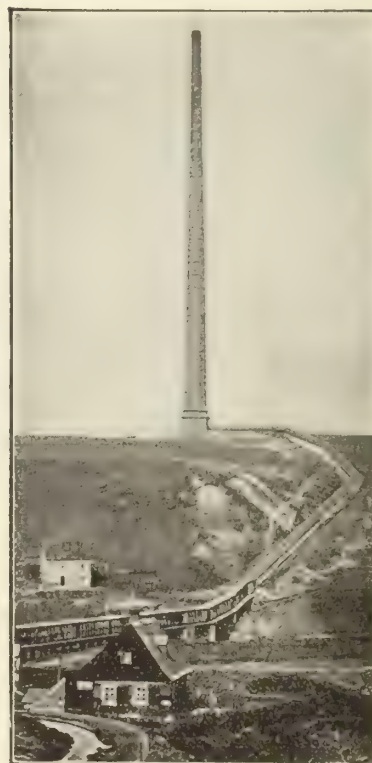
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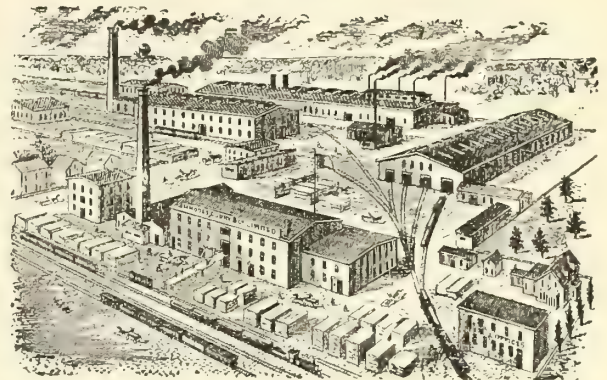
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Current Prices of Building and Engineering Materials

General Review of Market Conditions

There is evidence of improved business conditions in the construction field, and though business is by no means normal, still it is much better than it was at the beginning of the year. Structural steel is fairly active, the steel industry generally continuing to improve. At present there are many buildings throughout Canada calling for fair tonnages, so that with the gradual opening up of constructional undertakings it may be safely anticipated that the requirements in the near future will be substantial. Many improvements will be made by the various railroads shortly, and this should affect very largely the market for construction materials.

The demand for brick has greatly improved in the last couple of weeks. Most of the principal plants in Eastern Canada are now working at full capacity in order to satisfy a greatly increasing demand. For crushed stone demand is also likely to be good as the season opens up. This also applies to sand and gravel. In the cement field the prospects generally are said to be satisfactory. There is every reason to believe that the demand for cement and brick will be more general than usual. It is generally anticipated that the many extensive building undertakings in contemplation in many parts of the country will have the desired effect of stimulating the market, and opening up business in a satisfactory manner.

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Toronto prices (wholesale) delivered:

Cement—delivered in 5-barrel lots, \$2.25 per bbl.; car lots, \$1.55.

Lime—grey 38c, white 40c per 100 lbs., delivered in not less than 1500 lb. lots. At the warehouse, white 37c, grey 35c.

Brick—No. 1 dry pressed red and buff brick, \$18; common red stock brick, \$13 to \$15; grey, \$11.50 to \$12; wire-cut brick for foundation work, \$11; No. 1 enamelled brick, all colors, from \$80 to \$150; tapestry brick, \$23 to \$32; sand-lime brick (a) \$8.10, King Edward siding, (b) \$10.50 delivered on the job.

CRUSHED STONE, SAND AND GRAVEL

Toronto prices, delivered:

Crushed stone—2-in., \$1.30; 1-in., \$1.40; 3/8-in., \$1.40; rubble stone, in car lots, \$1.30 per ton.

Sand—for cement or brick work, \$1.20 per cu. yd., f.o.b. Toronto, C. P. R. siding; 85c to \$1 per cu. yd. f.o.b. Toronto, G. T. R. siding.

Gravel—\$1.50 per yard delivered

LUMBER (BUILDING MATERIAL)

Toronto prices (wholesale) delivered:

Hemlock—2 x 4 in. to 2 x 12 in., 8 to 16 ft., \$24; 18 ft., \$26; 1-in. Hemlock No. 1 \$25; No. 1 Hemlock decking \$25 to \$26; No. 2 hemlock, dimension and 1 in., \$19 to \$21.

Pine—1 in. common 8 to 12 in. wide (rough) \$26 to \$30; 2 in. white pine, bill stock, \$28 to \$34; 7/8 by 8 and 10 in. pine shelving, \$33 to \$42; 7/8 x 12 in. pine shelving \$45; No. 1 white pine flooring \$34; No. 1 spruce flooring \$28; No. 1 pine decking D 2 S \$28; spruce decking \$27 to \$30; No. 1 pine V. or beaded sheeting, \$35; No. 2 ditto \$32; pine trim 4 in. casing \$1.75 per 100 ft.; 5 in ditto \$2; 8 in. pine base \$3.25; 10 in. pine base \$4.50; 4 in. pine, window stool, \$2.75.

Shingles—XXX B. C. clear shingles \$3; N. B. extras \$4; N. B. clears \$3.45; No. 1 pine lath \$5; No. 2 pine lath \$4.75; No. 1 spruce lath \$4.25.

Dimension Timber (B. C. Fir)—8 x 8, 10 x 10, 10 x 12, 12 x 12, 12 x 14, 8 x 10, 8 x 12, 10 x 14, 14 x 14, 8 x 14, 12 x 16, 14 x 16, 16 x 16, \$32; 10 x 16, 14 x 18, 16 x 18, \$39; 8 x 16, 12 x 18, 18 x 18, \$36; 16 x 18, 14 x 20, 16 x 20, \$36.50; 8 x 18, 12 x 20, 18 x 20, \$40; 10 x 20, \$37.50; 8 x 20, 14 x 22, 16 x 22, 18 x 22, 20 x 22, 22 x 22, \$45; 12 x 22, \$39; 10 x 22, \$39.50; 8 x 22, 14 x 24, 18 x 24, 20 x 24, 22 x 24, 24 x 24, 12 x 24, 10 x 24, \$45.

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Sewer Pipe—Toronto prices (wholesale) f.o.b., 4-in., 25c per ft.; 6-in., 40c ft.; 9-in., 70c ft.; 12-in., \$1 ft.; 15-in., \$1.40 ft.; 18-in., \$1.90 ft.; 20-in., \$2.25 ft.; 24-in., \$3.25 ft.; all less 60 per cent.

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White lead—ground in oil, \$8.75 per 100 lbs.

Boiled linseed oil—in bbls., 68c per gal. of 9 lbs.

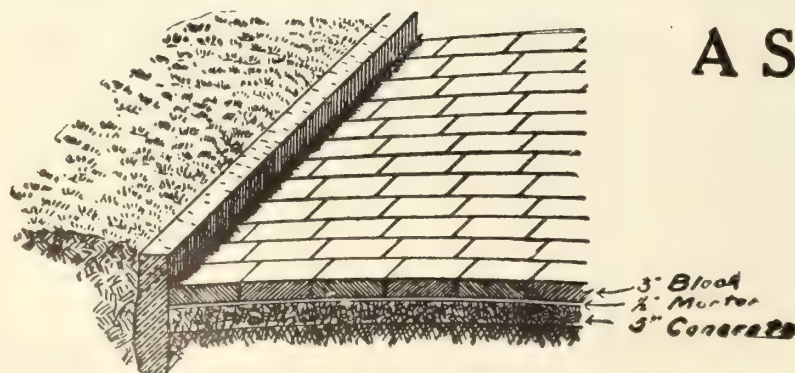
Raw linseed oil—in bbls., 65s per gal.; red lead, dry, \$7 to \$8 per 100 lbs.; putty in bulk, bbls., 3 1/2c.; putty in 25-lb. tins, 4c; turpentine, in bbls., 67c.

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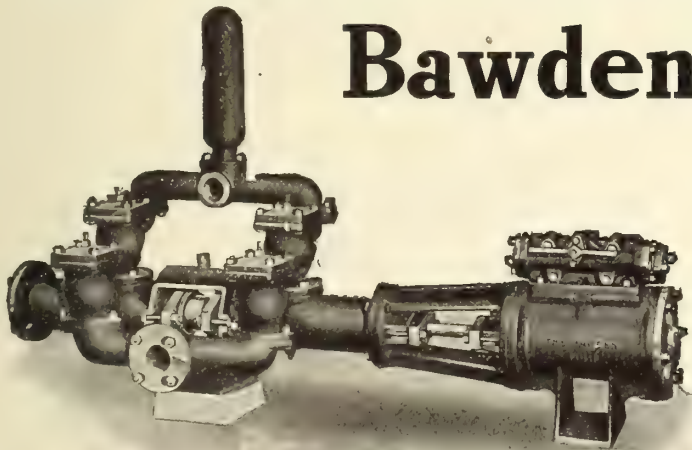
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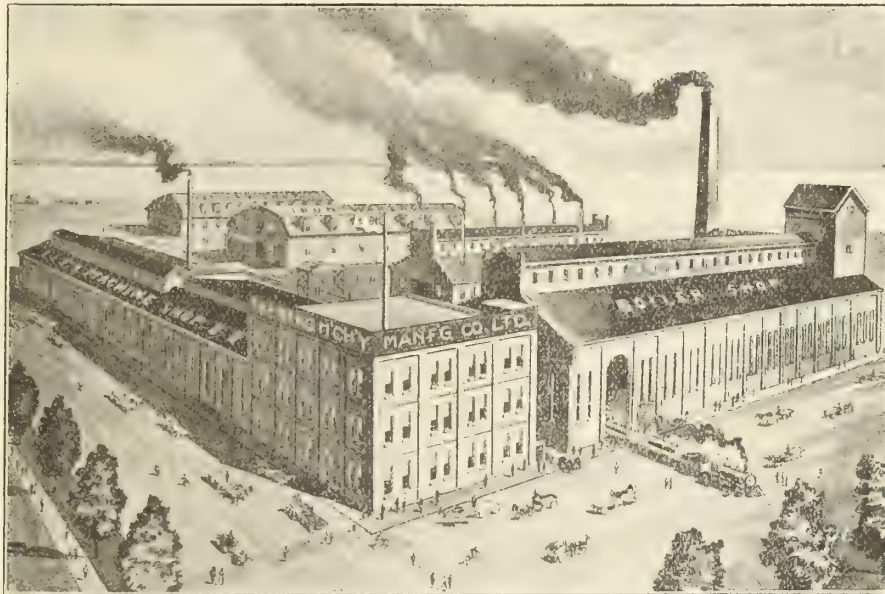
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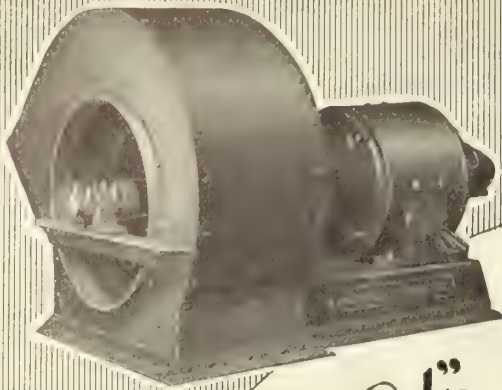
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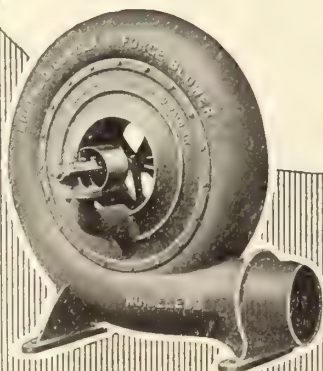
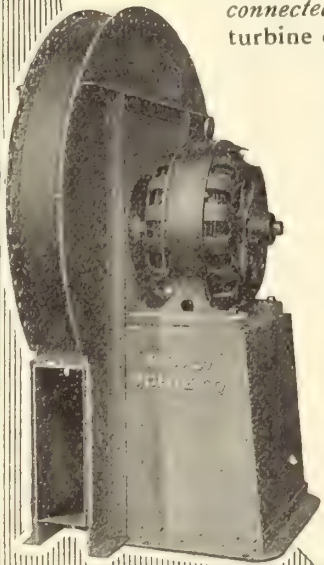
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Sewage Disposal in the United Kingdom, by Henry Lemmoin Cannon. Published in 1912 by St. Bride's Press, London. Eng. 320 pages; illustrated. Price \$1.00.

Strength of Materials, by Edward H. Maurer. Published in 1908 by American School of Correspondence. 128 pages. Illustrated. Price 75c.

The Modern Asphalt Pavement, by Clifford Richardson. Published in 1910 by John Wiley & Sons, New York. 630 pages; illustrated. Price \$2.00.

Text-Book on Highway Engineering, by Arthur H. Blanchard. Published in 1913 by John Wiley & Sons, Inc., New York. 762 pages. Illustrated. Price \$3.00.

Locks and Builders' Hardware, by Henry R. Towne. Published in 1904 by John Wiley & Sons. 1116 pages. Illustrated. Price \$1.50.

Sanitation of Public Buildings, by William Paul Gerhard, C.E. Published in 1907 by John Wiley & Sons, New York. 262 pages. Price 50c.

Iron & Steel, by O. F. Hudson. Published in 1913 by Constable & Company, Limited, London. 174 pages. Illustrated. Price \$1.00.

Asphalt Construction for Pavements and Highways, by Clifford Richardson. Published in 1913 by McGraw-Hill Book Company, New York. 156 pages. Illustrated. Price \$1.50.

Concretes, Mortars, Plasters and Stucco, by Fred T. Hodgson. Published in 1906 by Frederick J. Drake & Co., Chicago. 520 pages. Price \$1.00.

A Treatise on Cement Specifications, by Jerome Cochran. Published in 1912 by D. Van Nostrand Company, New York. 100 pages. Price \$1.00.

Specifications for Street Roadway Pavements, by S. Whinery. Published in 1913 by McGraw-Hill Book Company, New York. 116 pages. Price 75c.

School Architecture, by Edmund March Wheelwright. Published in 1901 by Rogers & Manson. 324 pages. Illustrated. Price \$1.00.

Applied Perspective, by William P. P. Longfellow. Published in 1901 by Houghton, Mifflin & Company. 98 pages. Illustrated. Price \$1.00.

Press-working of Metals, by Oberlin Smith. Published in 1896 by John Wiley & Sons, New York. 276 pages. Illustrated. Price \$1.00.

Reinforced Concrete Construction, by George A. Hool. Published in 1912 by McGraw-Hill Book Company, New York. 254 pages. Illustrated. Price \$2.00.

Building Stones and Clay Products, by Heinrich Ries. Published in 1912 by John Wiley & Sons, New York. 414 pages. Illustrated. Price \$2.00.

A Treatise on Concrete Plain and Reinforced, by Frederick W. Taylor. Published in 1905 by John Wiley & Sons. 584 pages. Illustrated. Price \$1.50.

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The Sanitation of a Country House, by Dr. Harvey B. Bashore. Published in 1905 by John Wiley & Sons. 102 pages. Illustrated. Price 50c.

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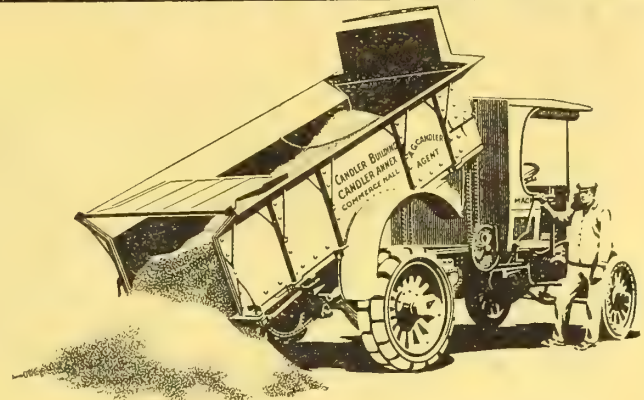
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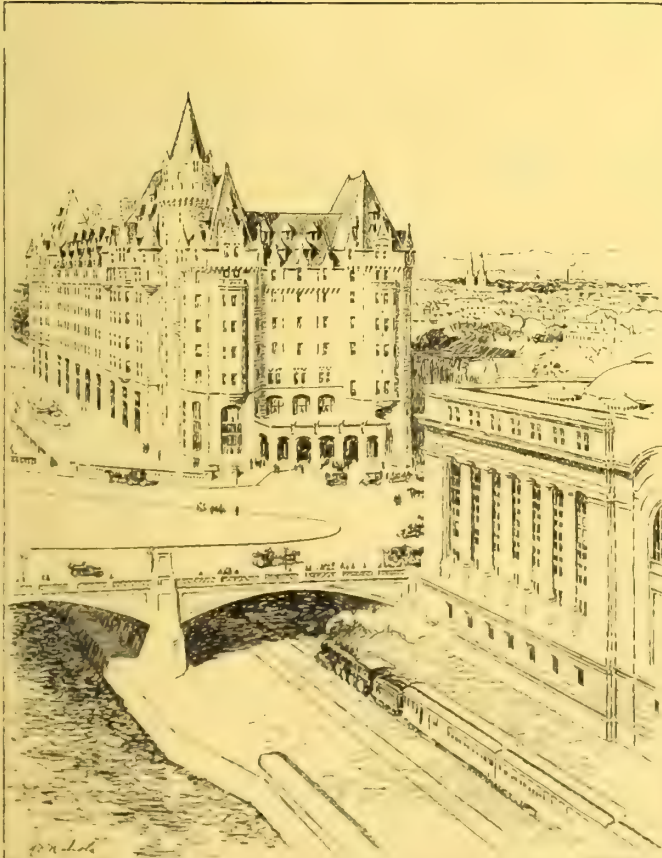
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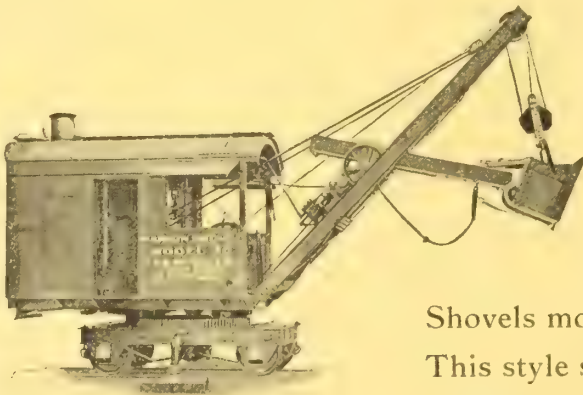
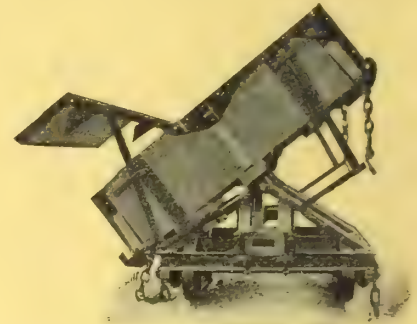
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